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Barloworld Equipment CAT

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Engine, Drive Train, and Hydraulic Repair Indicators

Machine life cycle management should combine preventative and predictive maintenance strategies to achieve optimal results.

Planned Indicators

Planned Indicators	Description
S•O•S℠ Services	S•O•S Services provide the best insight into internal component wear and potential failure.
Service Meter Hours	Each machine's Operating and Maintenance Manual gives general guidelines for servicing based on service meter hours.
Experience • Observation and Discussion	Talking with your machine's operator can reveal many potential component problems.
Service History	Service history indicates how frequently routine maintenance is performed.
Fuel Consumption	Indicates when a piece of equipment is operating at less than optimum efficiency.
Site Operations Maintenance Advisor (SOMA)	SOMA is a software that assesses customers operating and maintenance practices and provides component life estimates.

The following quick reference guides provide a useful checklist for identifying potential problems and their possible causes.

Cat Engine Repair Indicators

Problem Indicators	Possible Causes
Excess black smoke at full load (hot, unburned fuel)	Dirty primary/secondary air cleaner Operating in too high a gear Over fuelling Overloading
Increased fuel consumption	Malfunctioning fuel nozzles/injectors Malfunctioning turbocharger Dirty air cleaner Improper set point Fuel leak
Blue smoke (oil consumption)	Worn turbocharger seals Worn rings/liners Worn valve guides Hours on engine
White smoke (steam: water in combustion chamber)	Cracked head and/or liners Leaking head gasket
White smoke (on start-up: unburned fuel)	Incorrect starting procedure Incorrect fuel injection timing Faulty injector
Increased oil consumption (excess blow-by)	Worn or broken rings/liners Worn turbocharger seals Worn valve guides Hours on engine

Problem Indicators	Possible Causes
Unusual Noises	Malfunctioning fuel nozzles/injectors Malfunctioning turbocharger Worn piston pin bushings Worn rod/main bearings Too much valve lash
Lack of power	Incorrect adjustment of governor linkage Malfunctioning fuel nozzles/injectors Slipping torque converter Improper set point Dirty fuel filter Dirty air cleaner Low quality fuel
Overheating	Malfunctioning temperature regulator Incorrect adjustment or worn belts/pulleys Incorrect operator technique Plugged radiator core (external and internal) Low coolant level Dirty air cleaner

Cat Engine Repair Indicators (continued)

Problem Indicators	Possible Causes
Hard starting (engine missing)	Malfunctioning fuel nozzles/injectors Improper starting technique Worn fuel injector pump Slipping torque converter Low cranking speed Low quality fuel (low cetane rating or water in fuel)
Oil level over full	Coolant/fuel leak into crankcase Improper oil fill
Debris in oil filter	Coolant/fuel leakage into crankcase Extended oil change period Damaged bearings Incorrect oil use Dirt in entryway

Cat Final Drive Repair Indicators

Problem Indicators	Possible Causes
Brake Slippage	Worn plates and discs Wrong oil used Linkage out of adjustment
Unusual Noises	Worn plates and discs Dirt in entryway Low fluid level
Overheating	Wrong oil used Low fluid level Worn or damaged seals
Debris on Magnetic Plug	Dirt in entryway Wrong oil used Extended oil change period Disc disintegration Worn gears or bearings
Vibration	Gear failure Sprocket failure Bearing failure
Leaks	Worn, hard, cracked seals Sprocket failure Bearing failure

Cat Transmission Repair Indicators

Problem Indicators	Possible Causes
Hesitation/Slippage	Worn plates and discs Linkage out of adjustment Low fluid level Linkage not free Incorrect pressure settings Wrong oil used
Unusual Noises	Worn gears/bearings Dirt in entryway Aeration/cavitation Low fluid levels
Vibration	Bent drive shaft Gear failure Bearing failure
Overheating	Wrong oil used Plugged radiator Worn pump/pressure relief valve Worn or damaged seals Low fluid level Worn or dirty control valve
Debris in Filter/ on Magnetic Screen	Dirt in entryway Wrong oil used Extended oil change period Worn gears/bearings Disc disintegration
Leaks	Worn, hard, cracked seals

Engine, Drive Train, and Hydraulic Repair Indicators (continued)

Cat Differential Repair Indicators

Problem Indicators	Possible Causes
Bent or Damaged Lines	External damage
Unusual Noises (when travelling straight)	Worn gears/bearings Ring and pinion need adjustment Dirt in entryway Low fluid level
Unusual Noises (when turning)	Worn differential case assembly Worn spiders Worn spider gears
Vibration	Gear failure Spider failure Differential failure Bearing failure
Debris on Magnetic Plug	Contamination entry (dirt/debris) Extended oil change period Wrong oil used Worn gears/bearings
Leaks	Worn/damaged seals (pinion/ differential) Worn bearings
Overheating	Wrong oil used Low fluid level Worn or damaged seals

Cat Hydraulic Repair Indicators

Problem Indicators	Possible Causes
Leaks	System pressure too high Scored or bent cylinder rod Failed or incorrect seals Improperly torqued hose connection Worn or damaged hoses, tubes and fittings Missing guards
Excessive cylinder drift	Valve adjustment needed Scored cylinder Failed seal or seals Scored valve Contaminated oil
Slow cycle times	Engine performance Faulty Valve Low fluid level Worn system components Contaminated oil
Noisy operation	Engine performance Low fluid level Restriction in system Aeration Worn system components Faulty relief valve
System overheating	Faulty oil cooler Low fluid level Plugged filter Worn system components Faulty relief valve Wrong viscosity or contaminated oil Restriction in system Poor operator habits
Loose cylinder joints	Worn rod or cylinder eye/trunnion Poor lubrication Improper PM schedule
Blisters or abrasions in hose	Pinhole leaks in liner material Poor hose routing External damage System overheating
Excessive hose movement	Improper clamping or routing of hose Aeration/cavitation

Parts, service backup, far better with one solution

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UNDERCARRIAGE

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Cat Undercarriage is designed to work and wear as a system to reduce your operating costs. You make daily decisions that impact undercarriage wear and costs. This guide can help you and your operators understand how undercarriage works and how to reduce wear and save money. Although wear can't be halted, we are committed to helping you make each undercarriage system last with correct operation and maintenance.

Positive Pin Retention Track

Resists link end play and increases sealability for maximum track life

Designed for high impact and high loading applications such as mining, heavy construction, demolition, and waste disposal, Positive Pin Retention Track is an exclusive Caterpillar design that mechanically locks the link to the pin. This system:

- Resists end-play generation and link movement on the pin; and
- Increases joint sealability in applications where end-play growth can exceed the capacity of the seal.

Standard on D9T, D10T, D11R* and optional on D8T elevated sprocket tractors, Positive Pin Retention helps maximise undercarriage wear life and minimise your owning and operating costs.

*(*Current D11R link assemblies also contain Sleeve Bearing Track.)*

Exclusive design maximises track life

Positive Pin Retention Track features specially machined links and pins that allow for the use of a metal retaining ring. This ring is pressed into the groove between the pin and link, locking the joint to a predetermined factory end-play specification. This in turn:

- Prevents end-play generation (the outward movement of the links on the pin); and
- Ensures seal-to-bushing face contact and oil retention on sealed and lubricated track.

This exclusive Caterpillar design is recommended for mining, heavy construction, demolition, and waste disposal applications – conditions that generate high loading and impact, twist the track chain, and cause end-play.

Machines equipped with wider shoes, Extreme Service shoes, or Super Extreme Service shoes should also consider Positive Pin Retention Track.

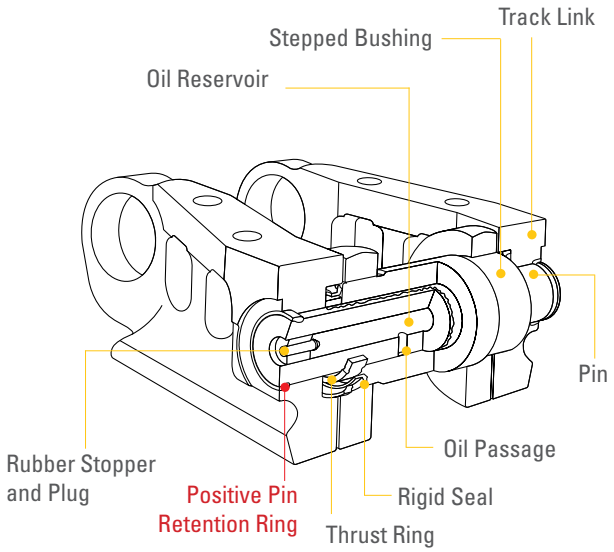
Undercarriage management lowers costs

To help you get the most from your Cat undercarriage, Barloworld Equipment offers the Cat Custom Track Service (CTS), a comprehensive programme for managing your track system. We analyse your application to determine if Positive Pin Retention Track will improve undercarriage wear life and lower your cost per hour.

By monitoring and inspecting your track regularly and providing reports that list service options, we help you make informed decisions – so you can plan maintenance and avoid costly unscheduled downtime.

When your track does need repair, we have the trained professionals, proper equipment, and excellent parts availability to get your machine up and running quickly and reliably.

Positive Pin Retention Track features specially machined links and pins that allow for the use of a metal retaining ring.



Heavy Duty Track

A sealed and lubricated track for medium size T, R, N and H-Series track-type tractors

Increased durability and wear life

T, R, N and H-Series machines, because of their versatility, are used in all types of underfoot conditions.

This tests the limits of undercarriage structural reliability, wear life, and sealability. Heavy Duty Track is designed to meet the needs of T, R, N and H-Series machines. It is strong enough for aggressive impact applications, yet has the necessary wear material for long life in abrasive conditions.

It features:

- Redesigned links, pins, and bushings for enhanced strength, durability, and retention.
- 20% additional rail wear material for extended system life.*

**Results may vary.*

Innovative design

Heavy Duty Track is more than an enhancement of conventional Sealed and Lubricated Track. It is a completely new design, engineered to match the requirements of medium size T, R, N and H-Series machines. It features redesigned links, pins, and bushings that significantly offset the effects of high impact loads and stresses. Additionally, 20% more wear material has been added to the links for increased wear life.

Combined structural and wear life enhancements result in lower owning and operating costs through:

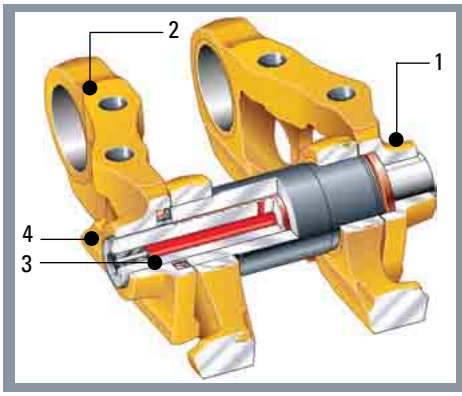
- Enhanced track joint retention and sealability.
- Stronger components that resist cracking and breakage.
- Extended system wear life.

Expect longer life

In most underfoot conditions, you can expect Heavy Duty Track to extend undercarriage system life an average 20%.

The greatest benefits are realised in aggressive, high impact applications such as:

- Logging/reforestation.
- Side-sloping work.
- Rocky conditions.
- Any uneven terrain with wide track shoes (specifically LGP machines).



1 Wider pin boss
2 Wider bushing strap
3 Longer track pin and bushing
4 More rail wear material

HEAVY DUTY COMPONENT	COMPARED TO SALT*	BENEFIT
Structural enhancements		
Link bushing strap	65% wider	• Greater bushing retention • Increased strength
Link pin boss	20% wider	• Increased pin retention
Bushing	10% longer	• More press fit area • Increased retention
Pin	14% longer	• More press fit area • Increased retention
Wear life enhancement		
Link rail	20% more wear material	• Extended link/roller system life

*SALT *stands for Sealed and Lubricated Track. Comparison percentages based on D6H.*

System Management

Undercarriage Optimisation

The Importance of Track Adjustment

Incorrectly adjusted track can cost you money both in accelerated undercarriage wear and downtime.

If the track is too tight, damaging non-productive loads are placed on the undercarriage and its manual components.

Tight track accelerates track wear and reduces tractor drawbar horsepower. Adjustment procedures take only a few minutes and require only one person. When adjusting your track on any Cat machine:

1. Always adjust the track in the working area.
2. Do not try to squeeze any packing material from in between the track.
3. Never loosen the relief valve more than one turn. Grease and oil are under extreme pressure and can penetrate the body, causing serious injury.

Operating Checklist

1. Always use the narrowest shoe possible, which still allows adequate flotation.
2. Minimise high operating speeds in non-productive situations, especially in reverse.
3. Alternate turning direction since turning only in one direction wears out one side of the machine faster than the other.
4. Rotate the track from side to side if you or your operators tend to work on one side of the machine more than the other.
5. Do not spin the tracks since it reduces production while increasing wear on all undercarriage components, especially on grouser bars.

Maintenance Checklist

1. Call your Barloworld Equipment parts and service representative for expert advice and service.
2. Adjust the track for correct tension. Always adjust track in its working environment. Correct track adjustment is critical.
3. Tighten the track hardware correctly, using Caterpillar's torque-turn method.
4. Make daily visual inspections of the equipment. Check for loose bolts, leaking seals, and abnormal wear.
5. Keep the undercarriage clean of mud and debris so rollers can turn properly.

Work it hard. Make it last. Fix it right.

Operating and Maintenance Tips

Cat Undercarriage is designed to work and wear as a system to reduce your operating costs. You make daily decisions that impact undercarriage wear and costs. This guide can help you and your operators understand how undercarriage works and how to reduce wear and save money. Although wear can't be halted, we are committed to helping you make each undercarriage system last with correct operation and maintenance.

Custom Track Service

Your undercarriage is an expensive investment. It accounts for as much as 20 percent of the price of a new track-type machine. Undercarriage can represent as much as 50 percent of machine maintenance costs.

Our goal is to help keep your undercarriage operating cost per hour or per km as low as possible. That's why we developed Custom Track Service (CTS).

Our parts and service representatives:

- Have the best training and tools to manage your undercarriage system.
- Regularly inspect and measure wear on your undercarriage.
- Prepare reports with maintenance and repair alternatives so you can make informed decisions to reach the lowest possible cost-per-hour or per km of operation.

While there is no substitute for Custom Track Service, you also play an important role in maintaining undercarriage life. The following pages describe conditions and situations that affect undercarriage and highlight ways you can help slow or reduce wear.

Factors Affecting Wear

Application

The type of job the machine is doing and the type of materials it is working in can affect the rate of wear on different components. The following situations all assume level terrain:

Dozing and push loading usually shift the machine weight toward the front, causing faster wear rates on the front rollers and idlers.

Ripping and drawbar shift the weight toward the back, increasing wear on the rear rollers, idlers, and sprockets.

Loading, as with a carry dozer, shifts the weight from the rear to the front of the machine as it changes from digging to carrying. Wear will occur more on the front and rear rollers than the centre ones.

Excavating shifts the weight to the side where the digging is being done. Spreading dumped material tends to create more wear on the undercarriage side where the operator hits the pile, due to the material entering the undercarriage from the side.

Packing

During operation, materials can stick to and pack between mating components such as rollers, links, sprocket teeth, and bushings. Packing prevents parts from engaging correctly. This can cause higher loads and increased wear rates. Packing is inevitable in many applications. However, there are things you can do to reduce the effects of packing.

- Use centre punched shoes in certain situations to help relieve extrudable materials such as wet sand, clay, or snow.
- Clean out your undercarriage as often as possible. Garbage, twigs, stones, and demolition debris cannot be extruded through the centre punched shoes.
- Use roller guards only when necessary because they may trap debris and increase the effects of packing. They are designed primarily for use in high impact underfoot conditions.

Terrain
Most of the time you can't control the terrain you are working in. However, it is important to understand how contours and slopes affect undercarriage wear.

Working uphill shifts the weight and load balance to the rear, causing higher wear on rear rollers and increasing forward drive side sprocket and bushing wear.

Working downhill shifts weight and load balance forward causing a relatively higher wear rate on front track rollers and idlers.

Working on a side hill shifts the weight and load balance to the downhill side of the machine. This increases the wear rate on the components and parts on the sides that are on the upper side of the hill.

Working on a crown shifts the load to the inboard components, increasing wear on inner links, inner roller, idler treads, and grouser ends.

Working in a depression shifts the load to the outboard components, increasing wear on outer links, outer roller, idler treads, and grouser ends.

Factors Affecting Wear

Always use the narrowest shoe possible
Use narrow shoes which still provide adequate flotation for your application. Proper flotation helps to reduce wear by keeping track from being submerged in material, but using wider shoes than required by your application can lead to:

- ***Increased bushing and sprocket wear***
  Turning resistance, loads, and weight increase with wider shoes, especially in rough underfoot conditions. This added stress causes faster wear rates for bushings and sprockets.
- ***Increased link, track roller, idler tread, and flange wear***
  Using shoes that are too wide increases the interference between these surfaces, causing them to wear faster.
- ***Loosening of pins, bushings, and shoe hardware***
  Leverage forces increase with wider shoes. In high impact or especially rough terrain, greater leverage forces may lead to premature loosening of bolted and pressed-fit components.
- ***Reduction of track joint life***
  Bending forces are exaggerated when using wide shoes in high impact applications, causing pressed track joints to "open up." This may lead to loss of lubricant, internal wear, and replacement or reconditioning of track joints sooner than expected.

- ***Shoe breakage***
  Severe turning resistance in extreme conditions and bending forces may cause wide shoes to break.

Your parts and service representative can help determine the best shoe width for your underfoot conditions.

Control the operation of your machine
One of the best ways to protect your machine against unnecessary wear is to make sure it is used properly. All of the following can cause additional wear on the components of your undercarriage:

- Slipping the track reduces production and increases wear on all undercarriage components, especially on grouser bars.
- Avoid unnecessary reverse operations. Non-productive reverse operation compounds bushing and sprocket wear. If the machine must be taxied from one location to another, reverse operation will cause more bushing wear regardless of speed.
- Operating the machine at a non-productive high speed may cause link, tractor roller, and idler tread wear. Wear increases proportionally to speed.
- Always turning the machine in one direction may cause link side rail/track roller flange and idler flange wear. Wear increases on one side of the machine because of the greater horsepower and distance travelled.

Be sure your track is always properly adjusted
Every application affects undercarriage wear differently and requires proper track adjustment. Adjust your track in the underfoot conditions in which your machine is working. For example, if track that is correctly adjusted for a non-packing application is put into a packing situation, packing materials will increase track tension, making the track adjustment too tight. Added track tension increases both the load and the wear on all mating components of your undercarriage.

Improperly adjusted track can result in problems and wear on other components such as:

- ***Bushing and sprocket accelerated wear***
  Tight track increases loads which advances wear. Wear occurs as the bushing rotates and/or slides in the sprocket.

- ***Link, track roller, and idler accelerated wear***
  To a lesser extent, tight track increases loads between the links, rollers, and idlers. This particularly accelerates wear on the idlers. For information on how to adjust your track, see *Track Adjustment Procedures*.

Undercarriage repair options
Maximise the life of your undercarriage and reduce your cost per hour by taking advantage of these undercarriage repair options:

- Wet bushing turn.
- Idler resurfacing.
- Track shoe regrousering.

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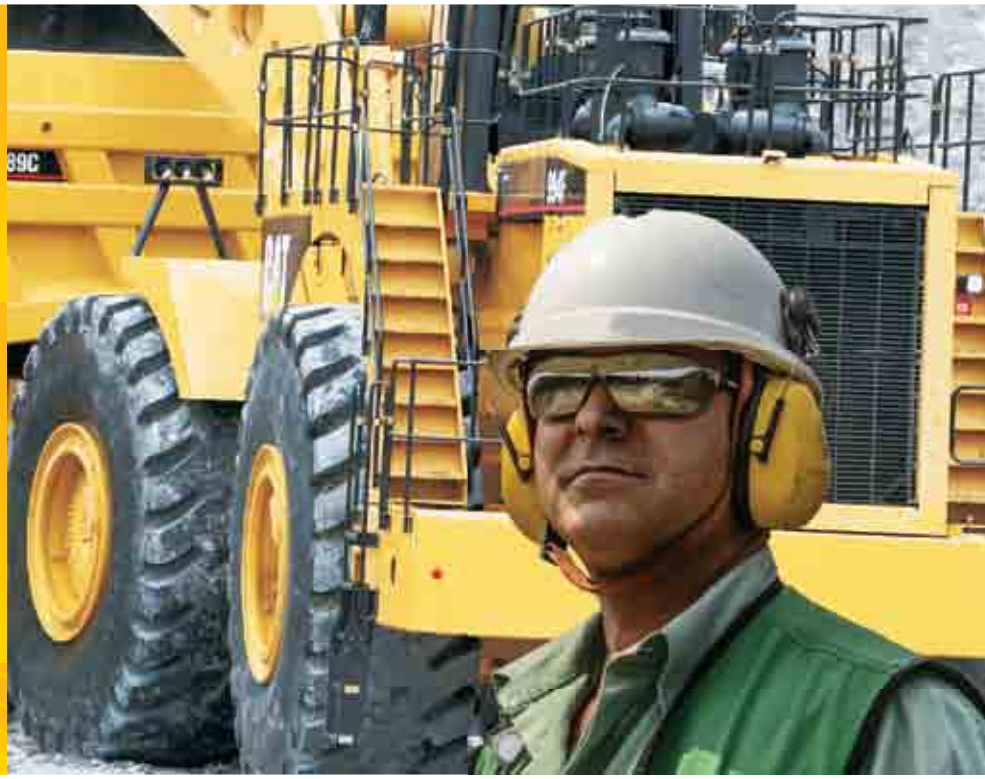

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Track Adjustment Procedures

Elevated Sprocket Tractors

1. Move the tractor forward and let it coast to a stop without applying the brakes. Make sure slack is between the sprocket and front idler. Then park the machine and turn off the engine. Place a tight line over the grouser tips from the sprocket to the front idler.

2. For machines without carrier rollers, measure the distance "A" from the line to the grouser tip at the lowest point of sag. Refer to Chart 1 to determine the correct sag for each model.

   For machines with carrier rollers, measure the distance from the line to the grouser tips in two places at the lowest point of sag between the front idler and carrier roller "A" and between the carrier roller and sprocket "B." Then average the two measurements. Refer to Chart 2 to determine the correct sag for your model.

   For SystemOne machines with or without carrier rollers, refer to chart 3.

3. If your track requires adjustment, locate the hydraulic fill and relief valve in the rear roller frame, and remove the inspection cover. Using a manual grease gun, add grease at the adjustment mechanism to tighten the track. To loosen the track, open the relief valve and allow grease to escape. Then close the relief valve.

4. Operate the machine in forward and reverse; then re-measure track tension. To avoid damage to internal roller frame components, do not allow the length of the exposed tube "B" to exceed the dimensions listed in Chart 4.

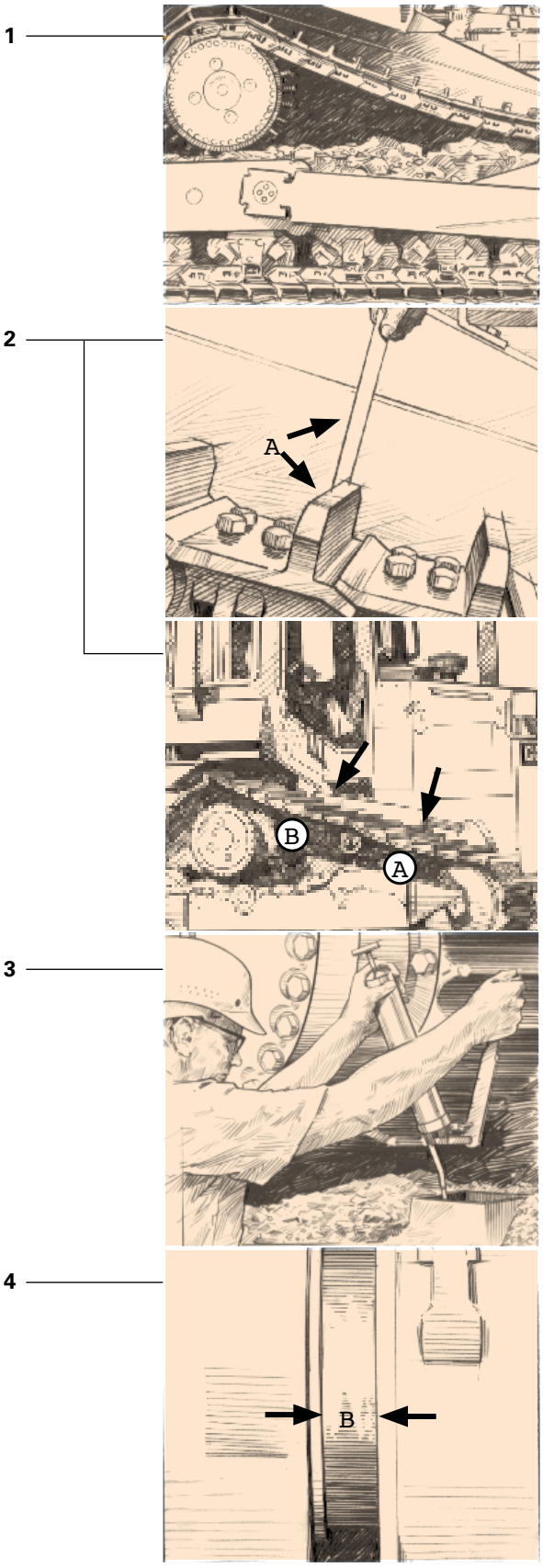


Chart 1.
Proper Track Sag
Machines without carrier rollers

	Inches			Millimetres		
Model	**Min**	**Target**	**Max**	**Min**	**Target**	**Max**
D11T, D11R, D11N, D10	6.1	6.5	6.9	155	165	175
D10T, D10R, D10N, D9L, 589	5.7	6.1	6.5	145	155	165
D9T, D9R, D9N	4.7	5.1	5.5	120	130	140
D8T, D8R, D8N, 578, 583T/R	4.1	4.5	4.9	105	115	125
D8L	5.1	5.5	5.9	130	140	150
D7R, D7H, 572R	4.1	4.5	4.9	105	115	125
D6T, D6R, D6H, 527	4.1	4.5	4.9	105	115	125
D5H, D4H, 517, 561H, 561M	3.5	3.9	4.3	90	100	110

Chart 2.
Proper Track Sag
Machines with carrier rollers

	Inches			Millimetres		
Model	**Min**	**Target**	**Max**	**Min**	**Target**	**Max**
D11T, D11R, D11N, D10	2.6	3.0	3.4	65	75	85
D10T, D10R, D10N, D9L, 589	2.4	2.8	3.2	60	70	80
D9T, D9R, D9N	2.2	2.6	3.0	55	65	75
D8T, D8R, D8N, D8L, 578, 583T/R	2.2	2.6	3.0	55	65	75
D7R, D7H, 572R	2.2	2.6	3.0	55	65	75
D6T, D6R, D6H, 527	1.8	2.2	2.6	45	55	65
D6N, D6M, D5H, 517	1.8	2.2	2.6	45	55	65
D5N, D5M, D4H, 561H, 561M	1.0	1.4	1.8	25	35	45

Chart 3.
Proper Track Sag SystemOne™
*Machines with carrier rollers**

	Inches			Millimetres		
Model	**Min**	**Target**	**Max**	**Min**	**Target**	**Max**
D8T, D8R	2.2	2.6	3.4	45	65	75
D6T/R/H, D6N/M, D5H	1.6	1.8	2.0	40	45	50
D5N/M, D4H	1.0	1.4	1.8	25	35	45
Machines without carrier rollers*						
D8T/R	3.1	4.5	4.9	80	115	125
D6T/R/H	4.1	4.5	4.9	105	115	125

** If excessive track jumping occurs, run the track adjustment to the minimum side of the track sag range.*

Chart 4.
Track Roller Frame Extension Specifications
Machines with and without carrier rollers

Model (Serial Number Range)	Inches	Millimetres
D11T, D11R (AAF) (7PZ) (9TR00202-UP (9XR00154-UP)	7.8	198
D11R, D11N	7.0	178
D10T (RJG), D10R (AKT) (3KR01331-UP), D10	7.3	186
D10N (2YD1-515)	5.8	148
D10R (3KR1-1330), D10N (2YD516-UP)	6.8	173
D9T (RJS), D9R (ACL) (ABK) (8BL1422-UP) (7TL1212-UP)	7.0	178
D9R (8BL1-1421) (7TL1-1211), D9N	5.9	150
D9L, D8L, 589	6.5	165
D8T, D8R, 583T/R (7XM5094-UP) (6YZ) (KPZ)	6.0	152
D8R (7XM1-5093), D8N (9TC) (5TJ)	5.6	142
D8 T/R SystemOne	6.0	152
D8N, 578 (9TC) (5TC)	5.6	142
D7R – STD, XR	5.4	136
D7R – LGP, 572R	5.4	136.5
D7H – STD, XR	5.0	126
D7H – LGP	5.0	127
D6R – STD (2YN1-544) (3ZN1-763)	6.2	156.8
D6T, D6R – STD (2YN545 and UP) (3ZN764 and UP) (AFM) (AEM)	5.8	147.5
D6R – XR (6JN1-415) (7KN1-450)	6.2	156.8
D6R – XR (6JN416 and UP) (7KN451 and UP)	5.8	147.5
D6R – LGP (8LN1-528) (9PN1-1578)	6.0	151.8
D6T, D6R – LGP (8LN529 and UP) (9PN1579 and UP) (ACJ) (ADE)	5.6	142.5
D6R – XL (4MN1-503) (5LN1-2765)	6.0	153.5
D6T – XL, XW, LG, D6R – XL (4MN504 and UP) (5LN2766 and UP)	5.7	144.2
D6R – XW	5.7	144.2
D6H – STD, XR	6.4	161.8
D6H – LGP, 527	6.2	156.8
D6H – XL	6.0	153.5
D6N/M – XL	4.0	102.4
D6N/M – LGP	4.3	108.2
D5N/M – XL	3.6	91.7
D5N/M – LGP	3.5	88.5
D5H, 517	4.4	112
D4H, 561H/M	3.9	100

Low Sprocket Tractors and Loaders

1. Move the machine forward and let it coast to a stop without applying the brakes. Then park the machine and turn off the engine. Place a tight line over the grouser tips from the sprocket to the front idler. Track sag should be about 50 millimetres. If your track requires adjustment, complete the following steps.

2. Connect the grease gun to the fitting at the track adjustment mechanism "A" located under the inspection plate. "B" is the front idler bearing assembly.

3. Add grease to extend the hydraulic track adjuster until the idler is at maximum forward position. The relief valve should remain closed. After adding grease, the track should be almost straight between the front carrier roller and idler.

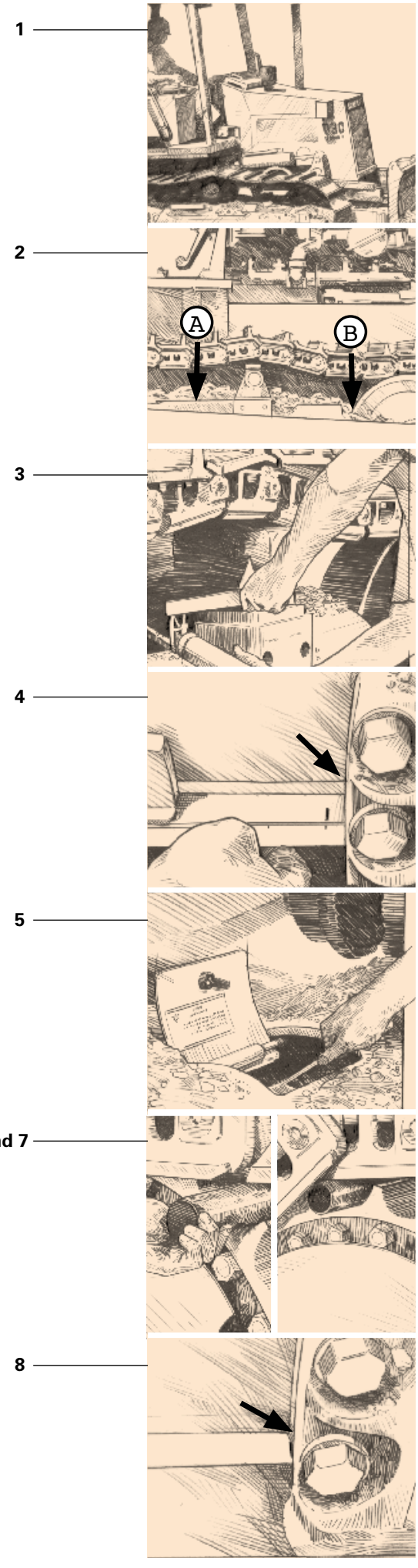
4. On machines with one carrier roller per side, place a mark on the track roller frame 10 mm behind the rear edge of the front idler bearing assembly "B." On machines with more than one carrier roller per side, mark the track roller frame 13 mm behind the rear edge of the assembly.

5. Open the hydraulic relief valve.

6. Place a track pin or drawbar pin between the sprocket teeth near the link assembly.

7. Travel in reverse until the idler backs up at least 13 mm. Move the machine forward until the pin is free of the track, then remove the pin.

8. Close the hydraulic relief valve. Using the grease gun, extend the hydraulic track adjuster until the rear edge of the idler bearing assembly aligns with the mark on the roller frame. The resulting sag should be about 50 mm. Operate the machine in forward and reverse, then reinspect track adjustment.



Hydrostatic Loaders

1. Move the machine forward and let it slowly come to a stop. Then park the machine and turn off the engine. Place a tight line over the grouser tips from the sprocket to the front idler. Measure the distance from the line to the grouser tips at the lowest point of sag. Proper track tension is about 50 mm.

2. If the track requires adjustment, remove the cover for the adjusting mechanism. Connect the grease gun to the fitting. Add grease to move the idler forward until the track is tight.

3. Using a straight edge, make a mark on the rod even with the recoil housing "A."

4. Place a second mark on the rod 10 mm from the first mark, in the direction of the idler. On the Cat 973, place the mark on the rod 13 mm in the direction of the idler.

5. Open the relief valve and let the idler drift back until the second mark is behind the recoil housing. Then close the relief valve. Using a grease gun, move the idler forward until the second mark is even with the recoil housing. The resulting sag should be about 50 mm. Operate the machine in forward and reverse, then reinspect the track.

6. As wear increases on the track link and rolling components, the distance between the piston "B" and recoil housing "C" will increase. Consult a Caterpillar Service Manual or contact us when the distance exceeds:

- 50 mm on 943 and 953 track loaders; and
- 60 mm on 963 and 973 track loaders.

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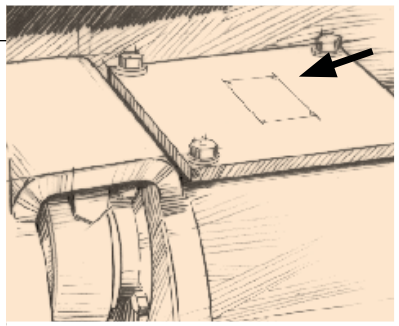

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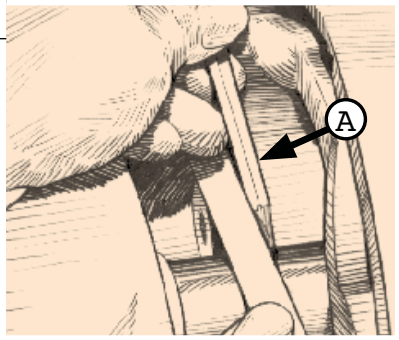

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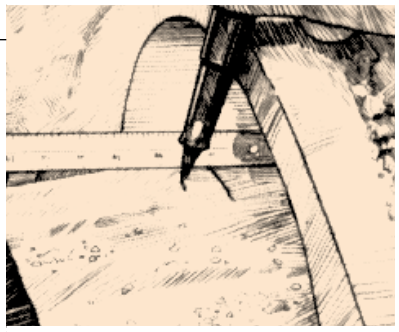

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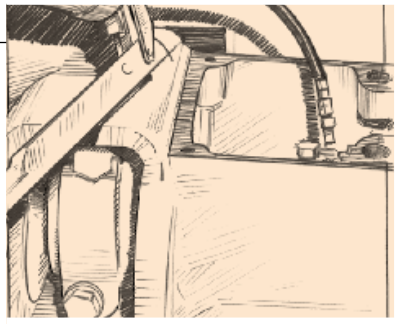

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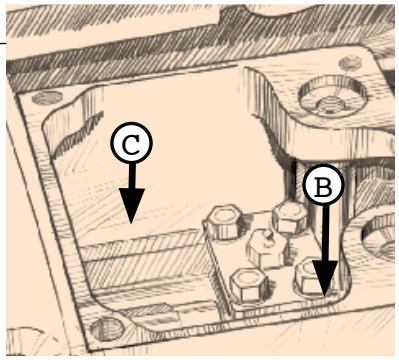

Hydraulic Excavators

1. Operate the machine in the direction of the idlers.

2. Stop with one track pin directly over the front carrier roller. Park the machine and turn off the engine.

3. Place a tight line or straight edge on top of the grousers between the front carrier roller and idler.

   Measure the distance from the straight edge to the grouser tip at the lowest point of sag, midway between the front carrier roller and idler. Refer to the chart below to determine the correct sag for each model.

4. If the track is too tight, loosen it by opening the relief valve and allowing grease to escape.

5. Tighten track by adding grease at the hydraulic fill and relief valve. Travel in forward and reverse to equalise tension throughout the track. Then reinspect adjustment.

Proper Track Sag						
	Inches			Millimetres		
Model	Min	Target	Max	Min	Target	Max
All 200-Family series excavators	1.0	1.3	1.5	25.0	32.5	40.0
All E-Family series excavators	1.6	1.85	2.1	40.0	47.5	55.0
All 300-Family series excavators	1.6	1.85	2.1	40.0	47.5	55.0
All 500 and TK-Family series excavators	1.6	1.85	2.1	40.0	47.5	55.0
5080, 5090B, 5130, 5130B, 5110B	1.6	1.85	2.1	40.0	47.5	55.0

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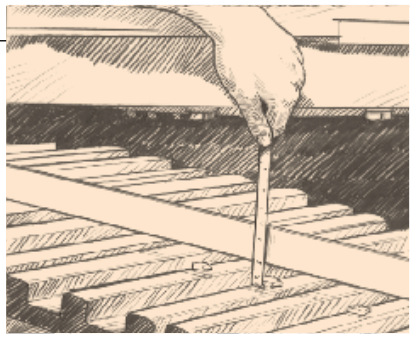

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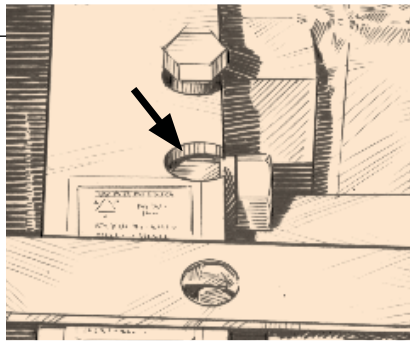

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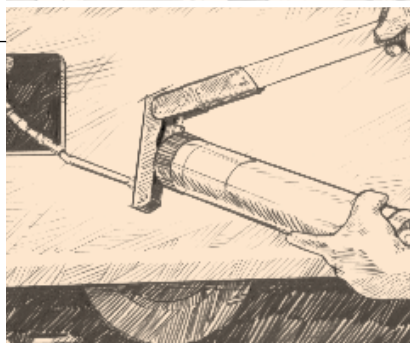

Hardware Requirements

Track Roller and Idler Caps

Inadequate clamping of the track roller and idler caps can result in broken retaining bolts and damage to the frame or bogie bore.

To install roller and idler hardware:

1. Lubricate the bolt threads with 5P3931 Anti-seize Compound.
2. Align the shaft and cap dowel holes to ensure proper bearing lubrication and shaft movement.
3. Completely tighten the bolt/bolts on the side having metal contact.
4. Completely tighten the bolt on the side that has a gap.
5. Tighten the bolts to the specified torque shown in the charts below.

Elevated Sprocket – Roller Hardware Torque Requirements

Model	Bolt Size	Torque
D4H, 943 with caps	5/8"	200 ± 20 lb ft (270 ± 25 N·m)
D5H, D4H, 953	5/8"	200 ± 30 lb ft (270 ± 40 N·m)
D5N, D5M, D6N,		
D6M, 953	M16	200 ± 30 lb ft (270 ± 40 N·m)
D6H, 963	3/4"	320 ± 45 lb ft (430 ± 60 N·m)
D6T, D6R, 963	M20	340 ± 50 lb ft (530 ± 70 N·m)
D7R, D7H, D8T, D8R,		
D8N,D8L, D9T, D9R, D9N	7/8"	550 ± 50 lb ft (750 ± 70 N·m)
D9L, D10T, D10R, D10N	1"	850 ± 75 lb ft (1125 ± 100 N·m)
D10	1-1/8"	1015 ± 105 lb ft (1350 ± 135 N·m)
D11T, D11R, D11N	1-1/4"	1650 ± 150 lb ft (2200 ± 200 N·m)

Elevated Sprocket – Idler Hardware Initial Torque Requirements

Model	Bolt Size	Torque
D5H, D4H	5/8"	200 ± 30 lb ft (270 ± 40 N·m)
D5N, D5M	M16	200 ± 30 lb ft (270 ± 40 N·m)
D6N, D6M	M16	220 ± 30 lb ft (300 ± 40 N·m)
D6T, D6R	M20	430 ± 60 lb ft (570 ± 80 N·m)
D6H	3/4"	360 ± 45 lb ft (475 ± 60 N·m)
D7R, D7H	7/8"	515 ± 65 lb ft (700 ± 90 N·m)
D8L	1"	850 ± 75 lb ft (1125 ± 100 N·m)
D9L	1-1/8"	1365 ± 105 lb ft (1850 ± 135 N·m)
D9L	1-1/4"	1650 ± 105 lb ft (2200 ± 200 N·m)
D9T, D9R, D9N, D8T, D8R, D8N	1-1/8"	1185 ± 150 lb ft (1600 ± 200 N·m)
D10T, D10R, D10N, D10	1-1/4"	1700 ± 220 lb ft (2300 ± 300 N·m)
D11T, D11R, D11N	1-3/8"	2220 ± 260 lb ft (3000 ± 350 N·m)

Sprocket Segment

The principal cause of segment loosening and subsequent loss and/or damage to other parts is incorrect segment hardware installation.

To install segment hardware:

1. Lubricate the bolt threads and the washer face of the nut with 5P3931 Anti-seize Compound.
2. Tighten all nuts on any one segment to the specified initial torque shown in the chart. This draws the mating parts together tightly.
3. Tighten each nut an additional 1/3 turn. This stretches the bolt properly for good retention.

Elevated Sprocket – Sprocket Segment Hardware Initial Torque

Model	Bolt Size	Initial Torque
D6T, D6R, D6N, D6M, D5N, D5M D5H, D4H	5/8"	130 ± 30 lb ft (175 ± 40 N·m)
D8T, D8R, D8N, D8L, D7R	3/4"	220 ± 40 lb ft (300 ± 50 N·m)
D9L	7/8"	650 ± 50 lb ft (870 ± 70 N·m)
D9T, D9R, D9N	7/8"	480 ± 50 lb ft (650 ± 70 N·m)
D10T, D10R, D10N, D10	1"	650 ± 50 lb ft (870 ± 70 N·m)
D11T, D11R, D11N	1-1/8"	650 ± 50 lb ft (870 ± 70 N·m)

Low Sprocket – Sprocket Segment Hardware Initial Torque

Model	Bolt Size	Initial Torque
D4K, D3K, D4G, D4C, D3G, D3C, 935	1/2"	50 ± 8 lb ft (70 ± 10 N·m)
953C	M16	75 ± 15 lb ft (100 ± 20 N·m)
D6K, D5K, D6, D5G, D5C, D5, 973, 963, 955, 953B, 943, 939	5/8"	130 ± 30 lb ft (175 ± 40 N·m)
D7, 977, 973	3/4"	220 ± 40 lb ft (300 ± 50 N·m)
D9, D8, 983	7/8"	\250 ± 50 lb ft (340 ± 70 N·m)

Conventional Shoe and Link

The number one cause of shoe loosening is improperly tightened shoe hardware. Use the following procedure to tighten your track bolts.

1. Lubricate the bolt threads and bolt washer faces with 5P3931 Anti-seize Compound.
2. Install Self-Locking Track Nuts with the rounded corners against the link.
3. Tighten the bolts to the specified initial torque shown in the chart below.
4. Give each bolt an additional 1/3 turn. Initial torque draws the parts together tightly. An additional 1/3 turn gives the bolt correct stretch for good retention. This ensures that the bolt's maximum clamping force is used.

Elevated Sprocket Track – Initial Torque for fastening shoes and split master links

Track Size	Bolt Size	Initial Torque
D5N, D5M, D5H, D4H	5/8"	130 ± 30 lb ft (175 ± 40 N·m)
D7H, D6T, D6R, D6N, D6M, D6H, 527, 517	3/4"	300 ± 50 lb ft (400 ± 70 N·m)
D7R,D7H	7/8"	250 ± 50 lb ft (340 ± 70 N·m)
D8T, D8R, D8N, D8L, D8T SystemOne	7/8"	480 ± 50 lb ft (650 ± 70 N·m)
D9T, D9R. D9N, D9L	1"	650 ± 50 lb ft (870 ± 70 N·m)
D9H	1"	300 ± 50 lb ft (400 ± 70 N·m)
D10T, D10R, D10N, D10	1-1/8"	650 ± 50 lb ft (870 ± 70 N·m)
D11T, D11R, D11N	1-3/8"	1100 ± 110 lb ft (1500 ± 150 N·m)

Low Sprocket Track – Initial Torque for fastening shoes and split master links

Model	Bolt Size	Initial Torque
D4K, D4G, D4C, D3K, D3G, D3C, D3, 931, 935	9/16"	65 ± 15 lb ft (90 ± 20 N·m)
D5K, D5G, D5C, D5, D4, 953, 943, 941, 939	5/8"	130 ± 30 lb ft (175 ± 40 N·m)
D6, D7, 977, 973, 963, 955	3/4"	220 ± 40 lb ft (300 ± 50 N·m)
D8, 983, 973	7/8"	250 ± 50 lb ft (340 ± 70 N·m)
D9	1"	400 ± 50 lb ft (540 ± 70 N·m)

Excavator/Front Shovel Track – Initial Torque for fastening shoes

Model	Bolt Size	Initial Torque
225, 215, 213, 211, 205	5/8"	130 ± 30 lb ft (175 ± 40 N·m)
235, 231, 229, 225, FB227	3/4"	220 ± 40 lb ft (300 ± 50 N·m)
521, 522, TK711, TK721, TK722, TK741	3/4"	300 ± 50 lb ft (400 ± 70 N·m)
235	7/8"	250 ± 50 lb ft (340 ± 70 N·m)
245	1"	4\00 ± 50 lb ft (540 ± 70 N·m)
307	1/2"	165 ± 15 lb ft (220 ± 20 N·m)
307, 308	14 mm	185 ± 18 lb ft (245 ± 25 N·m)
311, 312, 313, 314	16 mm	130 ± 30 lb ft (175 ± 40 N·m)
315, 317, 318, 319, 320, 320S, 321, 322, 323, 324, 325, 511, TK711	20 mm	300 ± 50 lb ft (400 ± 70 N·m)
350	1"	370 ± 50 lb ft (500 ± 70 N·m)
330, 532, 541, TK732	22 mm	370 ± 50 lb ft (500 ± 70 N·m)
345, 551, 552, TK751, TK752	24 mm	370 ± 50 lb ft (500 ± 70 N·m)
365	27 mm	400 ± 50 lb ft (540 ± 70 N·m)
385. 5090	30 mm	675 ± 70 lb ft (990 ± 100 N·m)
5080, 375	27 mm	400 ± 50 lb ft (540 ± 70 N·m)
5130	1-3/8"	1100 ± 110 lb ft (1500 ± 150 N·m)
5110	1-1/8"	650 ± 50 lb ft (870 ± 70 N·m)

Split Master Link

The importance of correctly assembling and torquing cannot be overemphasised. Follow these steps for both new and used split master links.

1. Before installing the track, the point of connection for the master link must be clean and undamaged. Remove all paint from points of connection.
2. Use 4C5593 Lubricant or 5P3931 Antiseize Compound on master bolt threads.
3. Put master links together and check alignment of holes for master bolts. Install one master bolt in each link. The bolts must turn easily, by hand, in the threads.
4. Remove the bolts. Install the master track shoe and all four master bolts. Turn the master bolts by hand.
5. Tighten the master bolts to the specified initial torque shown in the chart.
6. Give each bolt an additional 1/2 turn. Give a 1/3 turn for D6T, D6R, D6H, D7H (SandL), D8L, D8T, D8R, D8N, D9L, D9T, D9R,D9N, D10T, D10R, D10N, 589, 578, 245, 235.

GROUND ENGAGING TOOLS (GET)

APPRECIATING THE CAT GET ADVANTAGE

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Understanding Bucket Wear

A worn bucket costs you money every day you run your machine. It means your loader or excavator works harder to accomplish less. Your productivity is cut and in most cases downtime for 'patch-up' repairs is increased. That's why regular bucket inspections are so important to ensure that signs of worn parts and structural damage are identified early before they can rob equipment owners of valuable production time.

Bucket bottom and end plates

The bucket bottom is an area that receives much abuse. As the bucket scrapes along the ground, the bottom wears thin resulting in cracked wear plates and weld areas. When wear patterns develop on bucket bottoms replace the wear plates before other bucket parts are affected.

Corner wear

The most critical wear point in your bucket is the corner. It receives the most abuse. Severely worn or cracked corners can cause other bucket components to wear faster.

The best way to reduce this kind of wear on general and multi-purpose buckets is with the Cat Corner Guard System.

For buckets with teeth, a bolt-on corner adapter and tip protect the bucket from excessive corner wear and protect the bucket bottom. For buckets with bolt-on edges, the Corner Guard System uses bolt-on end bits to protect the corners. For rock buckets you can weld a tooth in the corner to reduce corner wear. A two strap adapter will protect the bucket bottom.

The widest range of mining machines from one solution

You have to push every day. To meet tomorrow's deadline. To secure the next contract. To stay ahead of the competition. No matter what challenges lie ahead, Caterpillar and Barloworld Equipment are committed to bringing you machines, solutions and support to help your business keep pushing forward. **SAFETY BUILT IN.**

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"Never run a bare bucket: always use either bucket teeth or bolt-on edges."

Worn and missing tips and adapters

Much of your bucket's penetration capability depends on teeth. Even one or two missing teeth will reduce your bucket's digging ability. A missing tooth also speeds up base edge wear. Tips also protect the more expensive adapters.

A worn tip is almost as bad as not having any tips at all. Blunt or broken tips cut the bucket's digging ability, making it work harder to do the same amount of work.

Base edge scalloping

The base edge is the primary support for the entire bucket system. When it wears thin or cracks, it weakens the whole bucket structure. The bottom and sides of the bucket can warp and bend. Also cracks may develop in the weld areas of the bucket. All this means expensive repair and downtime. Downtime that could have been reduced through a programme of planned repair and maintenance.

You can reduce base edge scalloping by using either bolt-on edge segments or weld-on half arrow edge segments between the teeth. Edge segments protect the base edge from scalloping and bolt-on edge segments have the added benefits of being reversible and easily replaced.

Conservation – your answer to lower costs

Conservation is one of your best defences against rising maintenance costs. The following conservation practices have been tested and proven:

- Always replace worn edges with the latest Cat edges.
- Rotate bucket tips from the ends to the centre and from the centre to the ends.
- Turn bucket tips over. The results are a re-sharpened tip and extra wear life.
- Reuse rings and pins. Also inspect hardware for reuse and discontinue the practice of automatically burning it off.
- Minimise ground contact with the bucket. Some operators lower the bucket to the ground long before they are ready to enter the stockpile. This extra scraping unnecessarily wears the bucket bottom.
- Protect the bucket bottom with bolt-on or weld-on wear plates. They can prevent expensive structural damage to the bucket resulting in longer bucket life; and
- Lubricate the bucket linkage pins or install sealed linkage pins where possible.

D11 Carrydozer Edge Systems

Along with the new fully reversible line of dozer cutting edges, Caterpillar supplies a line of one-way dozer cutting edges for the D11 carry dozer.

The Cat reversible cutting edge system is available in three styles for Cat D11 carry dozers in either a 45mm thick, 60mm thick, or 60mm thick with ARM (Abrasion Resistant Material) configuration on a standard 19 inch wide plate.

Compared to an unsymmetrical edge of similar style, equipment owners will experience around a 31% reduction in GET cost per hour by using the reversible cutting edge system.

When installing this system, always bolt the cutting edge to the blade utilising the upper row of bolt holes.

One-way cutting edges

Along with the new fully reversible line of dozer cutting edges, Caterpillar has introduced a new line of one-way dozer cutting edges for the D11 carry dozer. These 406mm (16 inch) thick edges offer less throw away than previous generation Cat unsymmetrical edges translating into a 16% reduction in GET cost per hour.

Cat EEWL (Extreme Extended Wear Life) Cast End Bits

EEWL cast end bits are designed for Cat D11 and other selected track-type tractors that utilises a Semi-U Blade or Universal Blade. This cast end bit offers more wear material, easier installation, and decreased change-out times as it is shipped 'ready to install'.

The new D11 cast end bit is recommended for low to moderate impact and low to high abrasive applications. When installing the new EEWL cast end bits, it is recommended that EWL or EEWL cutting edges be installed to ensure a balanced system life.

The EEWL end bit has 237.7 lbs. of available wear material versus the EWL (Extended Wear Life) end bit with 147.9 lbs.

The mounting surface of the end bit, which attaches to the blade support, has been machined for optimum flatness. The mounting surface should be flat to ensure that maximum clamping force can be obtained, which allows better bolt retention. Having good bolt retention keeps the end bit tight against the blade support, greatly reducing the chances of end bit cracking and/or breakage.

Lifting Eyes

Another advantage of the Cat EEWL cast end bit is that "lifting eyes" have been designed near the top-face of the end bit, and topside for ease of handling and installer safety.

Lifting eyes enable safe installation and removal.

Cutting Edge Supports: An Integral System Component

The cutting edge support is an integral part of the blade structure to which the cutting edges and end bits are bolted. Together, they ensure guaranteed dimensional accuracy.

These cutting edge support plates are available for factory bulldozer blades on D6R through D11R track-type tractors.

The cutting edge support consists of a one piece element for Straight, Angle, and Carrydozer blades. The Universal and Semi-U blades use a three piece cutting edge support system that consists of one support in the centre along with another support for the right and left hand sides.

(Note to readers: Prolonged operation with loose hardware can cause the bolts to elongate the mounting holes in the support. This makes it increasingly difficult to keep hardware tight. Repeatedly burning off hardware also weakens the support around the bolt holes. If cutting edges and end bits are not replaced soon enough, severe wear and damage can occur to the cutting edge support. If a blade is suffering from any of these problems, a genuine Cat cutting edge support will ease the pain with its guaranteed dimensional accuracy.)

Front and rear perspectives: the mounting surface of the end bit, which attaches to the blade support, has been machined for optimum flatness.

Blade Maintenance and Production Tips

- Use new bolts and nuts when installing new GET components.
- When installing cutting edge bolts, start at the centre and work out toward the ends, or begin at one end and work to the other.
- When downtime and production schedules are key factors, it is usually more economical to turn or replace all edges and bits simultaneously, even though all parts are not completely worn.
- The torque values specified for GET plow bolts and nuts are greater than the standard specifications. However, after a short period of operation, the mating surfaces will seat more uniformly and the bolt torque will reduce to approximately standard values.
- During dozing, avoid excessive speed. Slow, steady prying force is more desirable than high-speed impact when a boulder or other tough obstacle is encountered. Speed also accelerates track wear and imposes potentially damaging loads on dozer frames, drive train, and hydraulics.

You have to push every day. To meet tomorrow's deadline. To secure the next contract. To stay ahead of the competition. No matter what challenges lie ahead, Caterpillar and Barloworld Equipment are committed to bringing you machines, solutions and support to help your business keep pushing forward.
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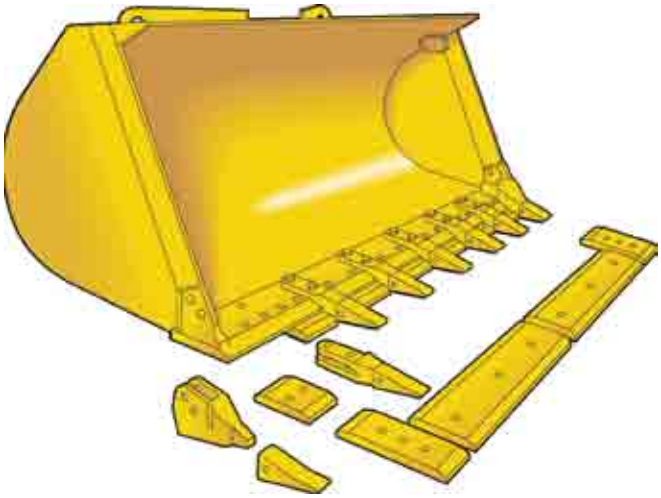
Barloworld Equipment CAT®

Bucket Corner Protectors

Even the toughest buckets undergo severe punishment in normal applications. That's why it is important to protect bucket corners from unnecessary wear.

Cat corner protectors are cast using DH-2 steel and are through hardened for longer wear life. These corner protectors have two bolt holes so they can be placed in the same location as 2-bolt corner adapters. They are compatible with all Cat bolt-on cutting edges.

The sharper profile increases penetration and production by funnelling loose material into the centre of the bucket.



Bucket corner configurations

Former buckets with 1-bolt corners can be re-worked to accept corner protectors by replacing the bucket corner with a 2-bolt corner piece. (Be sure to follow appropriate welding procedures with adequate pre-heat when working on hardened base edges/sidebars.)

- Penetrates better.
- Funnels material flow into the bucket.
- Increases productivity.
- Increases wear protection.
- Eliminates gaps between sidebar protectors and corner guards.

NEW SHARPER CORNER PROTECTORS FOR 924 – 988 LOADERS		
Model	**Corner Adapter Size**	**Increased Wear Material**
924G, 928G, 930G, 938G	J250	20%
950G, 953C, 960F, 962G	J300	19%
962G, 963C, 966G, 972G, 973C	J350	27%
980F, 980G, 980H, 988G, 988H	J400/J460	86%

Cat corner protectors are designed to protect bucket corners from wear when bolt-on cutting edges are used.

Caterpillar's new corner protectors feature extra wear material to make them last even longer.

Increases in wear material range from 19% in the J300 size to 86% in the J400/460 size. The new design for the J400/J460 adapter size allows for greater sidebar protection by eliminating the gap between the sidebar protector and corner protector on the Caterpillar 980G/H HDGP bucket system.

Caterpillar's new corner protectors feature extra wear material to make them last even longer.

Bolt-On Half Arrow Cutting Edges for 966-972 CGS Buckets

Cat bolt-on half arrow edge protection systems are ideal for abrasive and dense material applications where severe bucket wear can occur.

The system fits all Cat base edges drilled to accept standard and heavy-duty cutting edges and consists of three centre edges and two end edges. These cutting edges protect the full length of the bottom and leading edge of the base edge, where wear can be severe.

The half arrow profile provides protection for the front and top bevel area of the base edge. For still greater wear, centre and end edges with ARM (Abrasion Resistant Material) are available as an option.

Both the end and centre edges have lifting eyes that will aid in handling and installation. This is especially useful when changing edges in the field where fixtures and other mounting tools, aside from a simple hoist, are unavailable.

The end edges, which typically wear faster than the centre edges, are thicker to extend their wear life to more closely match that of the centre edges.

MACHINE MODELS	
Bucket Type: GCS	**Bucket Width(s)**
Cat 966D, E, F, G	3 035mm
Cat 966G	3 200mm
970/970F	3 035mm 3 200mm
972G	3 035mm 3 200mm

980 SERIES LOADERS

The bolt-on half-arrow cutting edge system is available for selected Cat 980 Series wheel loaders with CGS base edges.

Machine Model	980C	980F	980F	980G
Bucket Width	130.8″ (3323 mm)	130.8″ (3323 mm)	134.1″ (3406 mm)	134.1″ (3406 mm)
Bucket Type	CGS	CGS	CGS	CGS
Base Edge	7V4188 9V6574 7V0909	9V6574	111-9770	111-9770
Center Edge	217-4725	217-4725	217-4727	217-4727
Hardware-Cntr Edge Nut	(4) 3K-9770	(4) 3K-9770	(4) 3K-9770	(4) 3K-9770
Bolt	(4) 5P-8823	(4) 5P-8823	(4) 5P-8823	(4) 5P-8823
End Edge	217-4726	217-4726	217-4726	217-4726
End Edge (A.R.M)	229-6526	229-6526	229-6526	229-6526
Hardware-End Edge Nut	(3) 3K-9770	(3) 3K-9770	(3) 3K-9770	(3) 3K-9770
Bolt	(3) 5P-8823	(3) 5P-8823	(3) 5P-8823	(3) 5P-8823
Overall Edge Thickness	3″ (76 mm)	3″ (76 mm)	3″ (76 mm)	3″ (76 mm)
Bolt-plate Thickness	1 7/8″ (48 mm)	1 7/8″ (48 mm)	1 7/8″ (48 mm)	1 7/8″ (48 mm)

Cat J800 Retrofit

A hammerless tip option for Cat 994 wheel loaders and 385 hydraulic excavators

Incorporating Caterpillar's groundbreaking Cap-Sure™ retention design, the Cat J800 Retrofit system greatly simplifies the replacement of bucket tips.

As an alternative to conventional pin driven GET retention options, Caterpillar's Capsure innovation makes a major difference when it comes to faster serviceability and safer tool changeover times on specified Cat models.

A retrofit pin and washer inserted in the J800 adapter mates with the hammerless tip design, without introducing the need for special tools. The tip and retainer are one integral system.

All maintenance crews need is a 180 degree anti- or clockwise turn with a 19 mm (¾ inch) ratchet to either loosen or secure the Capsure locking system when replacing GET tips. A positive stop is cast into the tip and protector to prevent over-rotation. The tip locks and unlocks using approximately 136 Nm of torque.

The locking system placement is on the side of the tip, reducing exposure to wear, which results in easier change outs.

What to consider when choosing tips

Cat bucket tips come in diverse shapes and sizes: your selection will be determined by three factors, namely impact, penetration and wear.

Impact
Choose tips with the ability to withstand penetrating shocks, extensive digging and extreme breakout forces.

Penetration
Make sure the tips will penetrate tough material whether it's rocky, hard-packed or frozen. It's important to remember that sharp tips should only be used when penetration is more important than wear life.

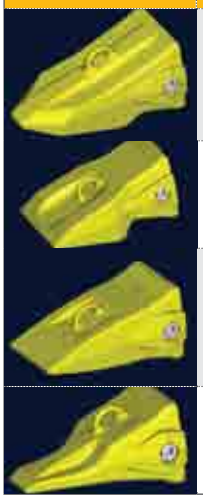
Wear
Select the tip that will withstand wear, gouging and abrasive action associated with material handling.

CapSure correct / incorrect locking sequence

A retrofit pin and washer inserted in the J800 adapter mates with the hammerless tip design, without introducing the need for special tools.

TIP STYLES

The J800 Retrofit option is available in the following tip styles:

	Style	Application	Benefit
	Heavy Duty Penetration	Hard to penetrate, highly abrasive materials.	Very good penetration: long life ensured by heavy wear pad.
	Heavy Duty Abrasion	Easy to penetrate, highly abrasive materials.	Long life ensured by heavy wear pad.
	Long	General excavation and loading.	Good combination of penetration, strength and wear material.
	Penetration	Hard-to-penetrate, low-abrasion materials.	Very good penetration. Tips stay sharp with use.

Choosing the right tip for the job site will increase safety and uptime.

A heavy duty abrasion tip, fitted with the CapSure locking system.

High Abrasion Buckets: Cat 990

New wider half arrow segments and top wear plates for Cat 990 high abrasion rock buckets: field proven in abrasive, low-to-high impact shot rock truck loading applications in mines and quarries.

New, wider half arrow segments and top wear plates provide enhanced value for Cat High Abrasion Rock Buckets by reducing the gap between the segment/top wear plate and adapter cover. This should eliminate wear in that area of the base edge, which can occur in some material conditions.

The segments match the adapter cover bottom thickness to provide flat under-bucket surfaces, while the half arrow shape protects base edge blunt height from wear. Top wear plates reduce wear on the bevel and the top front surface of the bucket base edge and are designed to match half arrow wear life, reducing bucket downtime for parts replacement.

Half arrows are 60 mm thick to match the bottom thickness of the adapter covers, providing a flat bottom surface. They have been made 60 mm wider across the front to reduce clearance between the segment and adapter cover. Top wear plates in turn are 25 mm thick and bent to follow the 35° base edge bevel.

You have to push every day. To meet tomorrow's deadline. To secure the next contract. To stay ahead of the competition. No matter what challenges lie ahead, Caterpillar and Barloworld Equipment are committed to bringing you machines, solutions and support to help your business keep pushing forward.
SAFETY BUILT IN.

For more information contact our call centre on 0800 21 22 48 orvisit www.barloworld-equipment.com

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Barloworld Equipment CAT

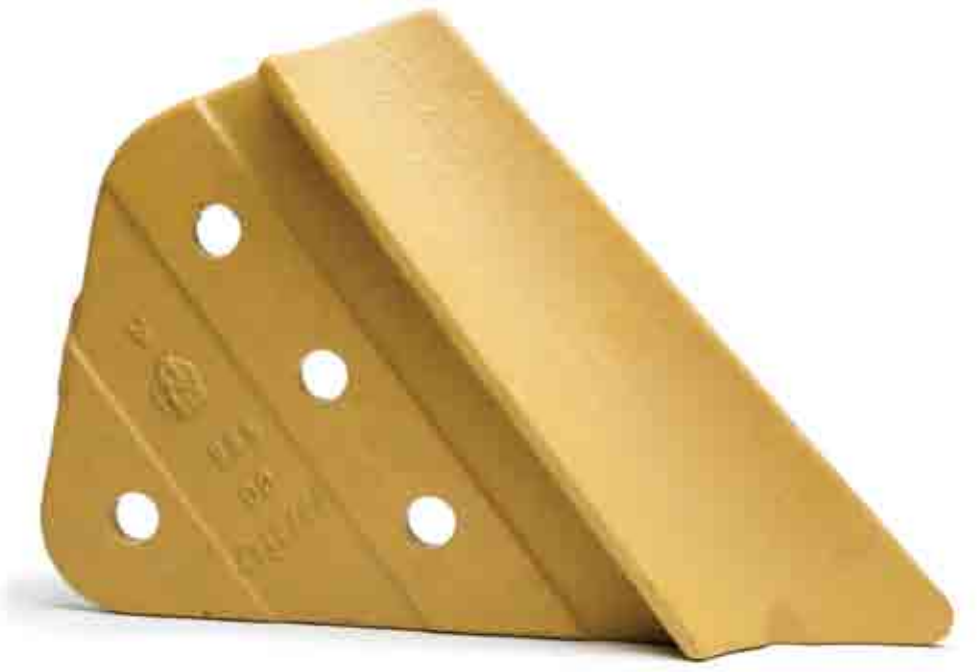
Side Cutters For K Series Buckets

For Cat 320 to Cat 390D L hydraulic excavators

Caterpillar's new side cutters feature an innovative design that offers a sharper profile, helping the bucket cut through tough material with less resistance, whilst staying sharper for longer. Additionally, the new side cutter profile increases heaping, which can help the bucket load more material.

These improvements in penetration and heaping promote a significant increase in productivity in nearly all digging and loading applications. It is estimated that bucket performance may increase up to 4% with the use of the new side cutters

As with all Cat GET, side cutter components are warranted against breakage for the normal wear life of the product. However, Caterpillar will not provide warranty coverage under the breakage terms of the warranty statement if the wear plates are worn beyond the wear indicators on the wear plate.



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Barloworld Equipment CAT®

Top Mounted Wear Plates for Wheel Loaders

General purpose and multi-purpose buckets

These wear plates are specifically designed for use with bolt-on half arrow cutting edges and will fit standard Cat base edges for selected wheel loader models with 119.5", 126" and 134.5" bucket widths.

These wear plates protect the bevel and top of the base edge along its entire length where wear can be severe in highly abrasive, dense material applications.

Description

Top mounted wear plates are made from through-hardened DH-2™ steel section for optimum strength and wear life. The wear plate system consists of two centre edges and a left and right-hand end edge. Each edge is approximately 16mm thick and is intended to match the wear life of the half arrow cutting edges so that maintenance is minimised.

Features

The wear plates are angled downward at the forward edge to tuck in behind the half arrow edge that sticks up above the base edge to provide unobstructed material flow.

The rear edge of the wear plates is tapered to a very low profile to reduce material "carry back" after a load has been dumped. The half arrow edges and the top mounted wear plates work together to protect the top and bottom surfaces of the base edge along its entire length.

The top mounted wear plates bolt in place quickly and easily, using longer cutting edge bolts and nuts.

"Lower your bucket maintenance and repair costs in abrasive loading applications."

MACHINE MODELS		
980F, G, H	966G, GII 970/970F 972G/972GII	962G11/963C 966D, E, F, G, GII 970/970F 972G/972GII 973C
BUCKET WIDTH		
134.1"	126"	119.5"
BUCKET TYPE		
CGS, MP	CGS, MP	CGS, MP

The Benefits

- Longer base edge life by eliminating wear on the upper surface of the base edge and in the area of the base edge bevel.
- Tight, bolt-on fit eliminates part-to-part wear from excessive movement.
- No danger of base edge cracking from hard-facing application.
- More uptime due to quick and easy wear plate removal and installation as compared to hardfacing application.
- Tapered rear edge prevents "carry back" of material.

Total Wear Protection

The Total Wear Protection line from Caterpillar consists of the Mechanically Attached Wear Plate System (MAWPS), heel shrouds, chocky bars, wear buttons, roll bars and wear blocks.

This wide variety of product designs and sizes allows for maximum wear protection in virtually any type of environment or application.

MAWPS Systems

The solid Mechanically Attached Wear Plate System provides a hammerless method for installation and removal of wear plates. MAWPS are available in a variety of sizes. Each size is also available in two different thicknesses: standard and heavy-duty.

The solid MAWPS is designed for extended wear protection in a variety of areas, such as bucket bottoms and sides, dozer push arms, hydraulic excavator ski runners and sides, and crusher hoppers. It offers equivalent wear protection at less weight than weld-on or bolt-on wear plates. The compression retainer provides a hammerless method of installation and removal, reducing downtime during replacement. It allows for quick replacement and makes it easy to swap out wear plates. The retainer snaps into place to firmly hold the wear plate to the base plate.

MAWPS allows you to achieve a greater payload over other manufacturer's wear protection systems without exceeding gross vehicle weight limits. Exceeding those limits can result in greater tyre wear, more fuel consumption, and a higher possibility of structural, drive train, and engine damage which can all greatly increase operating costs.

The skeletal Mechanically Attached Wear Plate System provides the same hammerless means of installation and removal as the solid MAWPS, but is for use in the rear portion of truck bodies. The skeletal plates are designed to trap material, allowing for material-on-material wear rather than wear on the steel body liner.

Mechanical, "Hammerless" Installation
The Mechanically Attached Wear Plate System consists of a wear plate, which slides onto a weld-on base plate and is held in place with a patented compression retainer. Worn wear plates can be quickly replaced without hammering or welding, making installation quick and easy.

Reduced Downtime and Maintenance
In two minutes or less, the wear plates can be changed, reducing downtime and maintenance.

Extended Wear. The system's patented compression retainer is positioned low in the base plate, allowing for a greater percentage of the wear plate to be worn away before replacement.

Versatility. The weld-on base plate can be welded onto virtually any flat or moderately curved surface that requires wear protection.

Wear Indicator. Inspections are quick and easy. When the holes become exposed in one or more corners, it is time to change the wear plate.

Each part features two layers, which are bonded together through a copper-brazing process.

Chrome White Iron (CWI). Heat-treated ASTM Class 2, Type B with a minimum hardness of Rockwell C 60 for high wear resistance.

Mild-Steel Backing Plate. Provides impact absorption for greater durability.

A range of Cat wear protection items, showing (top, clockwise) a wear block, chocky bar, wear button, and roll bar (centre).

ALL-ROUND PROTECTION

Heel Shrouds

Heel shrouds are used to protect the lower outside corner of all types of Cat buckets, as well as other brand buckets. The heel shrouds wrap around the bottom and side to give wear protection and structural support to the bucket. For moderate wear applications and sites especially concerned about mechanically fastened parts, these weld-on heel shrouds are an excellent option.

- Extra wear material is concentrated in the corner where it is most needed.
- The inside corner is reinforced to prevent interference with the bucket structure and weld joints.
- Straight and curved heel shrouds are available in two different sizes to best match bucket contour and size, as well as abrasiveness of the application.

Chocky Bars

Cat chocky bars, designed in four distinct shapes, conform to virtually any surface or application.

- The "V-groove" design allows these items to be bent around a radius (i.e. side bucket profiles) or separated to change the length requirement needed.
- The inset of the Cat logo allows for the trapping of fine material in each section, extending the life of the wear material itself.

Part Number	Part Name	Description	Length (mm)	Width (mm)	Thickness (mm)
280-4088	Block As.– Wear	1.5" Chocky	241	38	25
280-4089	Block As.– Wear	2.0" Chocky	241	51	25
280-4090	Block As.– Wear	2.5" Chocky	241	64	25
280-4091	Block As.– Wear	4.0" Chocky	241	102	25

Roll Bars

Cat roll bars are a unique product designed to protect the leading edge of earthmoving machinery such as dozers, loaders, and mining shovels.

- Their round profile is designed to provide maximum wear protection while minimising drag as the edge proceeds through the media.
- Roll bars offer impact deflection, improved media penetration, and overall weight reduction.

Part Number	Part Name	Description	Length (mm)	Width (mm)	Diameter (mm)
280-4096	Block As.– Wear	1.25" Roll Bar	229	38	32
280-4097	Block As.– Wear	2.0" Roll Bar	305	52	51
280-4098	Block As.– Wear	3.0" Roll Bar	305	69	76

Wear Blocks

Cat wear blocks are used in areas where a single piece needs to cover a large or specific surface area.

- The wear block has a thicker profile, which provides extended wear life in extreme applications.
- The "zig zag" inset design allows for material-on-material wear and prevents the detrimental channel wear common to wear plates that have grooves parallel to the direction of media flow.

Part Number	Part Name	Description	Length (mm)	Width (mm)	Thickness (mm)
280-4099	Block As.– Wear	6" x 8" Tile	203	152	38

Cat Wear Buttons

Cat wear buttons have been designed for use in applications that lend themselves to optimising their round profile, or where the round design is needed to cover a specific surface area.

- The buttons utilise a "tri-bar" design, which traps fine media between the three raised bars.
- The trapped media will provide material-on-material wear, prolonging the life of the product.

Part Number	Part Name	Description	Diameter (mm)	Thickness (mm)
280-4092	Block As. – Wear	2.5" Button	64	22
280-4093	Block As. – Wear	3.5" Button	89	29
280-4094	Block As. – Wear	4.5" Button	114	33
280-4095	Block As. – Wear	6.0" Button	152	35

Bolt Protectors

Designed to provide maximum protection to hardware and retention components, Cat bolt protectors are welded around the components to protect them from wear. Chrome white iron and a mild steel backing plate combine with a uniquely engineered design to provide an effective solution for a wide range of environments.

Wear Protection

Mechanically Attached Wear Plate System (MAWPS) (cont'd.)

Parts Consist

Mechanically Attached Wear Plate System

Series	Suggested Models	Base Plate (thk)	Wear Plate (dimension)	Compression Retainer	Radius Capability [1]	Retainer Plug
20 Series	844, 966, 980, 988, 345B, other similar sizes	138-0020 0.70 in thick (18 mm) 5.35 lb (2.43 kg)	138-0022 8.85 in x 7.87 in x 1.38 in (225 mm x 200 mm x 35 mm) 14.151b (6.42 kg)	138-0006	7.87 in (200 mm) minimum	275-5444
Heavy Duty	same	same	138-0023 8.85 in x 7.87 in x 1.97 in (225 mm x 200 mm x 50 mm) 23.91b (10.85 kg)	138-0006	same	275-5444
Heavy Duty ARM	same	same	264-2195	136-0006	same	275-5444
30 Series	854, 990, 992, 375, 5080, other similar sizes	138-0030 0.86 in thick (22 mm) 8.21b (3.72 kg)	138-0032 10.8 in x 7.87 in x 1.77 in (275 mm x 200 mm x 45 mm) 21 .3 lb (9.67 kg)	138-0006	15.75 in (400 mm) minimum	275-5444
Standard ARM	same	same	229-7067	same	same	275-5444
Heavy Duty	same	same	138-0033 (10.8 in x 7.87 in x 2.36 in) 275 mm x 200 mm x 60 mm 32.61b (14.8 kg)	138-0006	same	275-5444
Heavy Duty ARM	same	same	317-3350	138-0006	same	275-5444
40 Series	5110, 5130, other similar sizes	138-0040 1.14 in thick (29 mm) 10.151b (4.61 kg)	138-0042 10.8 in x 7.87 in x 2.36 in (275 mm x 200 mm x 60 mm) 29.251b (13.28 kg)	138-0007	31.50 in (800 mm) minimum	275-5444
Heavy Duty	same	same	138-0043 10.8 in x 7.87 in x 2.95 in (275 mm x 200 mm x 75 mm) 41.21b (18.7 kg)	138-0007	same	275-5444
50 Series	994, 5230, other similar sizes	138-0050 1.14 in thick (29 mm) 13.41b (6.08 kg)	138-0052 11 .81 in x 9.8 in x 2.95 in (300 mm x 250 mm x 75 mm) 55.25 lb (25.08 kg)	138-0007	47.25 in (1200 mm) minimum	275-5444
Heavy Duty	same	same	138-0053 11 .81 in x 9.8 in x 3.93 in (300 mm x 250 mm x 100 mm) 83.151b (37.75 kg)	138-0007	same	275-5444

Skeletal Mechanically Attached Wear Plate System

Series	Suggested Models	Base Plate (thk)	Wear Plate (dimension)	Compression Retainer	Radius Capability [1]	Retainer Plug
Standard	Off Highway Trucks	138-0020 0.70 in thick (18mm) 5.35 lb (2.43 kg)	138-0024 8 in x 12.2 in x 1.38 in (202 mm x 310 mm x 35 mm) 12.9 lb (5.9 kg)	138-0006	7.87 in (200 mm)	275-5444
Heavy Duty	Off Highway Trucks	138-0020 0.70 in thick (18mm) 5.35 lb (2.43 kg)	138-0025 8.15 in x 12.2 in x 1.77 in (207 mm x 310 mm x 45 mm) 18.3 lb (8.4 kg)	138-0006	7.87 in (200 mm)	275-5444

[1] Not recommended for convex radii smaller than those specified in this chart.

CAT
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Heavy-Duty Wear Plates: Quarrying and Industrial Buckets

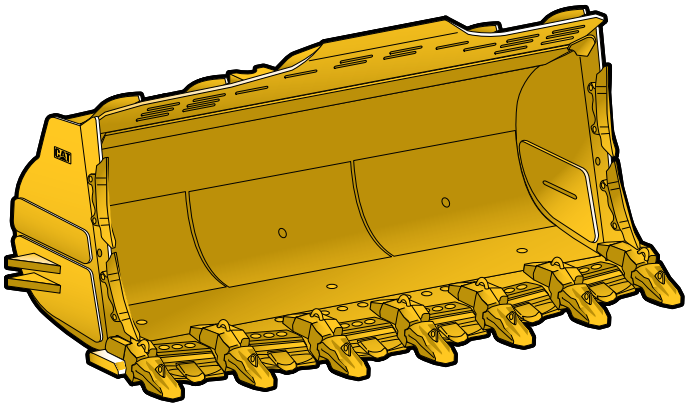
Abrasion Resistant Material Benefits

For tough applications, Caterpillar's top mounted wear plates with ARM (Abrasion Resistant Material) provide added durability for straight, spade rock and HD (heavy-duty) quarry buckets. These plates are used with bolt-on half arrow segments.

Wheel Loader Models

- Cat 988 (HD Quarry Bucket).
- Cat 990, 992C, 992D and 992G (HD Quarry, Straight, and Spade Rock Buckets).

ARM plates protect the bevel and top part of the base edge between the adapters where wear can be significant in moderate to high abrasive, dense material applications. Top plates are made from through hardened DH-2 steel section for optimum strength and wear life.



Plates are divided into three separate parts (Centre, Left Hand and Right Hand) to match the shape of the spade bucket. Straight base edges require only the centre top plate.

As an added benefit, the life of the top wear plate is intended to match the wear life of the half arrow so that maintenance is minimised.

Genuine Cat® parts - Find them on line!

Keep it Real. Keep it Cat® For more information contact our call centre on 0800 21 22 48 or visit www.barloworld-equipment.com

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Barloworld Equipment CAT

Motor Graders

Choosing the right Cat Ground Engaging Tools makes a difference in motor grader performance and productivity.

From the Cat GraderBits™ System to a range of moldboard components and more than 200 available cutting edges, Cat Ground Engaging Tools for motor graders are built to deliver superior performance and long wear life. Each provides certain benefits when used in the appropriate application.

This guide will help you make informed GET decisions when choosing the right cutting edge, which is critical for enhancing production and keeping total costs to a minimum.

The three factors to consider in choosing a cutting edge are:

• Shape. • Width • Thickness

Correct moldboard position

Correct moldboard position reduces wear and extends edge life. If the grading angle is too shallow, penetration will be poor and heat will build up on the edge. This causes mushrooming or slivering, which reduces edge life. (Slivering can also create a tyre hazard.)

Edge Shape

There are two basic edge shapes – flat and curved – with serrated edges available in both configurations. In addition, the Cat GraderBits System dramatically expands the range of edge shape options.

Edge width translates into wear material, so a wider edge usually delivers longer life. For example, a 203mm edge provides twice as much available wear material as a 152mm edge at only about 35% more cost. Plus hardware usage and edge replacement downtime will be cut by 50%.

To extend cost savings even further, a 254mm cutting edge will last three times longer than a 152mm edge when used under comparable conditions.

The influence of Crowning

Crowning is a normal wear pattern in which the cutting edge eventually conforms to the profile of the material being graded. When extreme crowning occurs or when finishing applications require tolerances of less than 6mm, the best value may be a narrower and/or thinner cutting edge. This reduces costs by minimising the amount of usable iron thrown away.

Edge thickness

Penetration requirements determine how thick your edge should be. Harder-to-penetrate materials call for the use of a thinner edge. In easier-to-penetrate materials, the edge can be thicker to extend wear life.

Flat Edges are usually wider and thicker than curved edges because they are designed for more demanding applications, including road maintenance and pioneering. In general, flat edges provide better abrasion and impact resistance.

Curved Edges are usually narrower and thinner than flat edges. They provide the superior penetration and rolling action necessary for fine grading and finish work.

Serrated Edges are designed to loosen hard-to-penetrate materials such as packed gravel, frozen earth and ice. Because of their ability to penetrate quickly, serrated edges may last longer in some applications. For the most severe impact conditions, they can be installed over a 6" (152 mm) edge for improved resistance to tooth breakage.

Cat GraderBits are part of the revolutionary Cat GraderBits System. These replaceable, tungsten carbide tipped bits extend downward from the blade like a row of teeth to provide the best possible combination of penetration ability and long life.

The quality of a moldboard cutting edge is usually judged on three factors:

- **Hardness.**
- **Wear resistance.**
- **Breakage resistance.**

Cat Tungsten Carbide Edges are available in all three basic shapes for use in areas of high abrasion and low–to–medium impact.

Cat Tungsten Carbide Cutting Edges combine the toughness of Cat DH-2 steel with the wear resistance of tungsten carbide. They provide extended life in highly abrasive conditions to lower operating costs. Tests show that tungsten carbide edges can provide up to 20 times the life of a standard DH-2 edge.

Features:
- Curved edge improves penetration and rolling action.
- Trapezoid-shaped tungsten carbide tile on leading edge stays sharp as it wears for improved penetration and longer wear life.
- Available in 609 mm and 914 mm sections for easy handling.
- Smaller, easier-to-handle edges allow rotation – substantially reducing downtime and crowning.
- Reversible DH-2 overlay end bits are available to protect end sections from damage.

Developed for high-abrasion, low-to-medium impact applications, such as:
- Unimproved earthen material roads.
- Public sand and gravel roads.
- Mining or logging haul roads.

Caterpillar GraderBits System
The Cat GraderBits System is a flexible, high production road maintenance edge system that saves time and money.

How Cat GraderBits Work
The GraderBits System starts with adapters bolted onto the moldboard in place of a conventional cutting edge. Like a row of bucket teeth, GraderBits are inserted into the adapter and are individually replaceable.

Each bit is held in place with a snap ring. Different sizes of GraderBits can be used in combination to create edge patterns that deliver optimum performance in a wide variety of surfaces – from rough haul roads to paved roads with compacted ice and snow.

Advantages Over Conventional Edges
GraderBits penetrate to the desired depth immediately – even on highly compacted surfaces – so shaving and scuffing are eliminated.

Fines and gravel flow through the gaps between bits and don't end up wasted in windrows. At the same time, subsurface gravel is brought back to the surface for reuse – greatly reducing the expense of spreading new gravel. As a result, most road maintenance jobs can be accomplished in a single pass.

Other advantages include:
- 6-10 times longer life than standard flat (1" x 10") through-hardened edges.
- Less time required on blade and edge maintenance.
- More distance covered in less time means lower overall cost per mile/kilometre.
- Significantly less new road material required.
- Better water retention helps control dust and erosion.

Caterpillar also offers high-carbon edges for those light-duty applications where impact is extremely low. High carbon edges have a relatively high surface hardness and will provide good life in high abrasion applications or in finish work. It is important to realise that high-carbon edges will not withstand the impact of a DH-2 edge and care should be taken to choose an application with very low impact.

Caterpillar utility edges are heat-treated DH-2 edges that offer an economical option for Cat 24H / 24m motor graders. These edges are intended for use in highly abrasive applications where high impact and breakage are not an issue.

Cat Moldboard Components

Cat moldboard end bits, overlays, repair plates and hardware help you protect, maintain and repair moldboards and working edges for longer life and lower total costs.

Overlay End Bits
Overlay end bits are recommended for applications such as ditching that cause severe wear on the cutting edge and moldboard corners. They add strength and limit corner wear, which extends cutting edge life when an edge would otherwise be thrown away due to excessive wear at the corners.

When worn on one side, overlay end bits can be rotated for a second wear life.

Moldboard End Bits
Cat moldboard end bits are recommended for all applications. Made of through-hardened DH-2 steel for added strength and service life, they protect moldboard edges from wear.

Moldboard Repair Plates
Most moldboard damage can be avoided through routine monitoring of cutting edge wear and timely edge replacement. But when unexpected damage occurs, repair plates provide a cost-effective way to extend moldboard life.

Hardware
Caterpillar Grade 8 hardware is performance-matched to Cat GET in both strength and durability. Grade 8 nuts and forged dome head bolts have a minimum proof load of 120,000 psi (830 MPa) and a tensile strength of 150,000 psi (1035 MPa).

When replacing ground engaging tools, always use Caterpillar standard hardware regardless of the application.

Motor Grader Edge Inspection and Installation
Before installing new edges be sure to carefully inspect the face and underside of the moldboard: check for bent or cracked areas as well as severe wear. If necessary, weld moldboard repair plates in place.

Excessive down pressure can dramatically shorten edge life.

If penetration is a problem, choose a thinner edge, a serrated edge or the Cat GraderBits System for the most compacted materials.

Scarifiers and Components

While the main focus of motor grader operations is the moldboard, there are also important choices to make when selecting scarifier components and ripper-scarifier tools.

Caterpillar offers a range of built-tough ripper and scarifier tools and components that make a difference by enhancing production and extending motor grader versatility.

Scarifiers are available in two configurations, V-Block and Straight Block. Both have tapered locking grooves to hold tips securely in place.

V-Block scarifiers are the best choice for breaking up blacktop and loosening compacted surfaces, rocky subgrades and frozen ground. Cat V-Block Scarifiers, also known as mid mounts, fit ahead of the blade, hold up to 11 shanks and loosen a path 46" (1168 mm) wide. They are available to fit Cat 12, 120, 140 and 112 motor graders.

Straight Block scarifiers are mounted on the rear of the machine and are best used for higher-speed applications (up to 3rd gear) in shallow, low-impact applications.

Available to fit Cat 12 and 14 motor graders, Cat Straight Block Scarifiers accept up to 17 shanks and loosen a path 72" (1828 mm) wide. In some light-duty applications, straight block scarifier arrangements may be used as a mid-mount scarifier.

Scarifier Shanks are through-hardened and tempered to resist wear, bending and breakage.
Shanks are available in two lengths:

- Short for most applications.
- Long for applications requiring extra penetration ability.

Scarifier Tips
Caterpillar offers three types of scarifier tips for use on washboarded and potholed road areas or where surface reconditioning is needed. They feature a range of materials to suit various ground conditions, with material combinations optimised for wear, strength and low operating costs. In normal to light-duty applications, the General Purpose Scarifier Tip will provide excellent reconditioning capabilities. The General Purpose Tip is made from through-hardened DH-2 steel and provides the lowest operating costs of the three options.

The Heat Resistant Scarifier Tip is made from DH-3 material and is intended for use in applications where surface temperature is in excess of 400O F. This material is specially formulated to resist the damaging effects of high temperatures and deliver longer wear life in applications where heat build up is a problem. One such application would include relatively deep penetration of more than 2" and contact with the road bed for extended distances of a kilometre or more.

Ripper-Scarifiers
Rear-mounted ripper-scarifiers enhance versatility over conventional forward-mounted scarifier configurations.

Simply by changing shank position, it's possible to either rip or scarify as work conditions require. Curved ripper shanks are recommended for continuous ripping in tougher materials.

Ripper tips for motor graders are available in two designs – centreline and penetration. Centreline tips are appropriate for most applications; whilst penetration tips are best for high-impact or hard-to-penetrate materials.

8" (203 mm) FLAT CUTTING EDGES

Edge Length

Edge	3'	4'	5'	6'	7'	8'	Bolt
Thickness	912 mm	1217 mm	1522 mm	1826 mm	2131 mm	2436 mm	Size*
0.75"	4Z8129**	4Z8119** a	4T3034	4T3007	4T3036	4T3035	0.63" (16 mm)
19 mm				4T3033	4T3032	4T3037	0.75" (19 mm)
1"		135-9692	7T3497	7T3499	7T3498	7T3496	0.63" (16 mm)
25 mm		4Z8926		7T3493	7T3494	7T3495	0.75" (19 mm)
Bolt Quantity	5	9	11	13	15	17	

** 12" (304.8 mm) centres on bolt holes. a 4Z8119 uses bolt quantity of 6.

10" (254 mm) FLAT CUTTING EDGES

Edge Length

Edge	6'	7'	8'	Bolt
Thickness	1826 mm	2131 mm	2436 mm	Size*
1" 25 mm	4T6502	4T6508	4T6511	0.75" (19 mm)

6" (152 mm) CURVED CUTTING EDGES

Edge Length

Edge	2'	4'	5'	6'	7'	8'	Bolt
Thickness	607 mm	1217 mm	1522 mm	1826 mm	2131 mm	2436 mm	Size*
0.63"	9W1835		7D4508	5D9553	5D9554	8J4043	0.63" (16 mm)
16 mm				9J3657	9J3658	9J3655	0.75" (19 mm)
0.75"			3G7966	5D9556	5D9557		0.63" (16 mm)
19 mm					4Z8785		0.75" (19 mm)
Bolt Quantity	4	9	11	13	15	17	

8" (203 mm) CURVED CUTTING EDGES

Edge Length

Edge	2'	4'	5'	6'	7'	8'	9'	Bolt
Thickness	607 mm	1217 mm	1522 mm	1826 mm	2131 mm	2436 mm	2743 mm	Size*
0.63"	109-3137 a	132-1088	7D4509	5D9562	5D9561	5D9731	0.63"	(16 mm)
16 mm	3G2166	134-1773		9J7701	7D1158	8J9821	0.75"	(19 mm)
0.75"	6G8623**	132-1087	9W6252	5D9558	5D9559	5D9732	195-7269	0.63"(16 mm)
19 mm	3G2165	109-3124	4Z8131** b	7D1576	7D1577	7D1949		0.75" (19 mm)
1"			253-0214	4T2240	4T2244	4T2242	4T2237	0.63" (16 mm)
25 mm		109-3150		4T2231	4T2233	4T2236		0.75" (19 mm)
Bolt Quantity	4	9	11	13	15	17		

** 12" (304.8 mm) centres on bolt holes. a 109-3137 uses bolt quantity of 5. b 4Z8131 uses bolt quantity of 7.

CATERPILLAR CURVED HIGH-CARBON STEEL CUTTING EDGE SIZES

			Length									
			4′	5′	6′	7′	8′	9′	10′	11′	12′	14′
Thickness	Width	Bolt Hole	(1219 mm)	(1524 mm)	(1828 mm)	(2133 mm)	(2438 mm)	(2743 mm)	(3048 mm)	(3201 mm)	(3353 mm)	(4267 mm)
1/2″ (13 mm)	6″ (152 mm)	5/8″(16 mm)	9W2293	9W2295	9W2297	9W2299	9W2301	4Z8968	9W2303		9W2305	9W2307
		3/4″(19 mm)	9W2294	9W2296	9W2298	9W2300	9W2302		9W2304		9W2306	9W2308
5/8″ (16 mm)	6″ (152 mm)	5/8″(16 mm)	9W2325	7T1640	7T1633	7T1645	7T1632			4Z8652	4Z8653	
		3/4″(19 mm)	9W2326	9W2327	7T1637	7T1626	7T1629					
1/2″ (13 mm)	8″ (203 mm)	5/8″(16 mm)	9W2309	9W2311	9W2313	9W2315	9W2317		9W2319		9W2321	9W2323
		3/4″(19 mm)	9W2310	9W2312	9W2314	9W2316	9W2318		9W2320		9W2322	9W2324
5/8″ (16 mm)	8″ (203 mm)	5/8″(16 mm)	9W2328	7T1641	7T1636	7T1643	7T1631					
		3/4″(19 mm)	9W2329	9W2330	7T1639	7T1624	7T1628					
3/4″ (19 mm)	8″ (203 mm)	5/8″(16 mm)	9W2338	9W2340	7T1634	7T1623	7T1630					
		3/4″(19 mm)	9W2339	9W2341	7T1638	7T1625	7T1627					

REPLACEMENT PARTS FOR SCARIFIERS

		V-Block	V-Block	Straight Block	No.6
Components		(Rear Notched)	(Front Notched)	(Rear Notched)	(Non-Current)
Shank					
	Standard	5B-0947	195-7218	195-7219	6K-5704*
	Long	7D-4501			
Tips					
	General Purpose(DH-2)	195-7234*	195-7234*	195-7234*	
	High Temperature (DH-3)	6Y-5230**	6Y-5230**	6Y-5230**	5K-0450*
	High Abrasion (A.R.M.)	143-3074**	143-3074**	143-3074**	143-3074**

* Uses DH-2 steel.

** Uses 6B-3260 tool for driving scarifier tips off shanks.

HARDWARE

Size	Application	Bolt	Nut	Washer
0.63″ (16 mm)	All	3F5108	4K0367	5P8247
0.75″ (19 mm)	Except 14G, 16G, and H Series	4F7827	2J3506	5P8248
0.75″ (19 mm)	140H, 143H, 160H, 163H, 14G, 14H	5J4773	2J3506	5P8248
0.75″ (19 mm)	16G except 16′ blade	5J4771	2J3506	5P8248
0.75″ (19 mm)	16H, 16G with 16′ blade	(20) 5F8933	2J3506	5P8248
0.75″ (19 mm)	(2 bolt part numbers for 16H and 16G with 16′ blade)	(22) 5J4771	2J3506	5P8248
1″ (25 mm)	24H	(16) 1J3527	2J3507	5P8250
1″ (25 mm)	(2 bolt part numbers for 24H)	(54) 4J9058	2J3507	5P8250

Note: The 140H and 143H Motor Graders use both 0.63″ (16 mm) and 0.75″ (19 mm) bolts depending on the blade group number. See table below for application.

Blade Group No.	Bolt Size
8X8011	0.63″ (16 mm)
8X8016	0.63″ (16 mm)
112-4520	0.75″ (19 mm)
112-4521	0.75″ (19 mm)

MOLDBOARD END BITS						
Grader		End Bit	Moldboard	Hardware		
Model	S/N	Qty.	End Bit	Qty.	Bolt	Nut
16G	93U1-93U2777		9D4880/1	4	4F7827	2J3506
16G, 16H	93U2778-Up	2	8E5530	5	1J6762 a	2J3506
16	All others		9J4407/8	4	3F5108	4K0367
14G	96U1-7324		9J4405/6	4	4F7827	2J3506
14G	96U7325-Up	2	8E5529	5	5J4773	2J3506
14	All others		7D2083/4	5	3F5108	4K0367
112, 12,	All	2	7D2052*	5	3F5108	4K0367
120, 130,			9W2945**			
140						
120H, 135H, 12G,		2	8E5531	5	3F5108	4K0367
12H, 140H, 143H						
with 5/8" holes						
160H		2	8E5529	5	5J4773	2J3506
212	All	2	9J4411	4	3F5108	4K0367
24H	All	2	109-3118	6	1J3527	2J3507

NOTE: For machines equipped with power blade arrangement, refer to the appropriate parts book for the correct moldboard end bit.
* Use 8E5531 End Bits on the following machines:
12G (61M11716-UP)
120G (87V08135-UP)
130G (74V02293-UP)
140G (72V09829-UP)
** 9W2945 is 1/8" (3 mm) thicker than 7D2052 and is recommended for use when installing overlay end bits.
a Use larger 5F8933 bolt where rear moldboard reinforcing plates are used.

MOLDBOARD REPAIR PLATES***			
Moldboard Length	Dimensions		
feet/mm	W-H-T (inch)	W-H-T (mm)	Part
13-14 3962-4267	75 x 15.25 x 0.38	1905 x 387 x 10	4D5821*
12-13 3658-3962	63 x 15.25 x 0.38	1600 x 387 x 10	4D5820**

* Use 8W5266 for larger radius moldboards. Radius is 16.25" (413 mm). ** Use 8W5265 for larger radius moldboards. Radius is 16.25" (413 mm).
*** Blank Plate without Bolt Holes .

You have to push every day. To meet tomorrow's deadline. To secure the next contract. To stay ahead of the competition. No matter what challenges lie ahead, Caterpillar and Barloworld Equipment are committed to bringing you machines, solutions and support to help your business keep pushing forward.
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Barloworld Equipment CAT

Underground Loaders

More life from new weld on bucket protection system

Caterpillar's new weld on GET for underground mining loaders is designed to be more productive than the previous half-arrow system and offers more wear material to maximise wear life and bucket protection.

This new weld-on system also reduces downtime. Traditionally, corners wear faster than edge segments causing the machine to be idled twice for maintenance. The new design was developed for an even wear rate between corners and edge segments, allowing both to be replaced at the same time.

The new system consists of four new parts: a right and left corner; along with two lengths of centre-edge segments (850 and 1150 mm long.) Centre-edge segments are offered in two lengths to minimise waste when cutting and fitting the parts.

Improved wear material for corner components ranges from 73 to 95%, and centres between 14 and 28%, depending on the GET model match.

Cat model match

Please note that only centre-edge segments should be used on Cat R1300 machines due to the narrower width of their buckets: using the corner segments reduces the spade profile. Machines larger than R1300s should use the corners with centre-edge segments.

For complete installation instructions, contact your Barloworld Equipment customer service representative.

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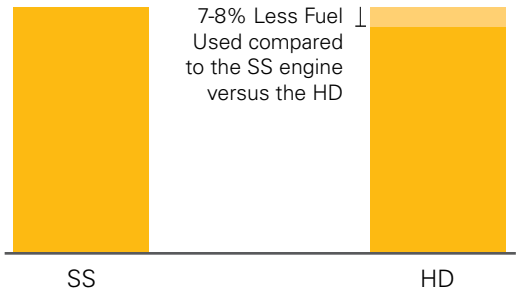
Cat 3516B High Displacement Engine Upgrade

For Cat 793B and 793C mining trucks

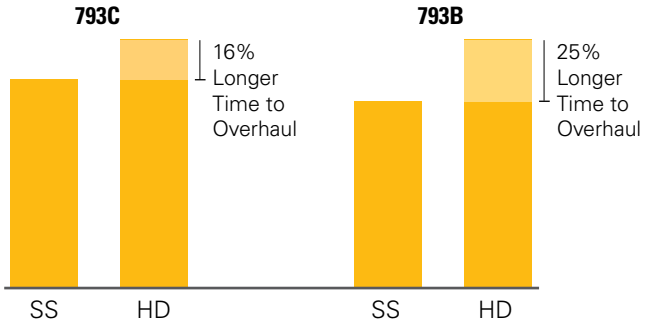
The Cat 3516B High Displacement (HD) engine upgrade delivers substantial savings by using less fuel, extending time between repairs, and lowering the overall cost per tonne. The Cat 3516B HD gets its improved performance from a 13% increase in displacement, compared to previous standard-stroke (SS) engines.

Owners of Cat 793B and 793C mining trucks can upgrade their equipment by purchasing an HD Reman engine and conversion parts package, and returning their old 3516 short-stroke cores.

FUEL CONSUMPTION IMPROVEMENT*



HOURS-TO-OVERHAUL IMPROVEMENT*



**Performance may vary, depending on application, load factors and other variables.*

HD Advantage

Features
- 13% more displacement.
- New turbos.
- Extended repair and maintenance intervals.

Benefits
- Significantly less fuel consumption.
- Better response.
- Lower repair and maintenance costs, and lower cost per tonne.

Electric Power and Marine:
Cat Certified Engine Rebuilds

3300/3400/3500/3600 Engine Family Series

An investment in productivity

A Cat engine is the best investment in productivity you can make. But eventually, every piece of equipment reaches the end of its useful life. Through the Cat Certified Engine Rebuild programme, a member of the Cat 3300, 3400, 3500 or 3600 engine family can be rebuilt for a second life, at a fraction of the cost of an engine replacement.

Rebuild specifications meet all Caterpillar standards, providing the kind of quality you have grown to expect. Parts are built to exact tolerances and undergo rigorous testing to ensure reliable performance.

These Cat Certified Engine Rebuilds also come with extended service coverage options, the latest required updates and optional performance enhancement upgrades, which could result in:

- Improved fuel consumption.
- Reduced emissions.
- Solutions for governmental or international regulations:
  - SOLAS Reg. number 15.2.9
  - SOLAS Reg. number 15.2.10
  - SOLAS Reg. number 15.2.11
- Reduced owning and operating costs.
- Technology upgrades like:
  - EIS Technology
  - G3600 ESS to ADEM III
  - G3500A Gas Compression EIS to ADEM III

Inspection/Evaluation
This vital first step is a thorough process during which we develop a customised rebuild plan and cost estimate for you.

Disassembly
Once the rebuild plan is established, your engine will be completely disassembled. The parts will be inspected and measured against our strict reusability guidelines. Those parts that do not meet our high standards will be replaced with new Cat parts.

Reconditioning
This phase of the process addresses equipment needs not typically included in an engine overhaul.

Engineering updates
During reassembly, your engine will receive any required updates and your choice of optional performance enhancement upgrades that have occurred since your engine was originally manufactured.

Reassembly
Our professional technicians will carefully and completely reassemble your engine.

Testing and validation
Following the original commissioning procedures of the rebuild process, the engine will be retested and re-commissioned.

Repainting
Your engine will perform like new and look like new, after a paint job. A Cat Certified Engine Rebuild decal will also be issued.

New Cat Certified Engine Rebuild identification numbers
A new Cat Certified Engine Rebuild number identifies your engine and entitles you to Caterpillar extended service coverage options.

Customer evaluation
The rebuild process is not considered complete until your operators are satisfied with the performance of your engine in its working environment.

Model coverage
Contact our Cat Certified Engine Rebuild team for 3300/3400/3500/3600 Engine family serial number specific data.

Cat Certified Engine Rebuild Extended Service Coverage

Inspection/Evaluation
The Cat Certified Engine Rebuild programme doesn't end with the rebuild process. The value of your engine is further increased with new-engine extended service coverage options.

Ask your Barloworld Equipment Customer Service representative for details on additional extended service coverage options available through the Cat Certified Engine Rebuild programme.

Available coverage:
- 2-year or 12,000 service hours
- 2-year or 16,000 service hours
- 3-year or 18,000 service hours
- 3-year or 24,000 service hours

AVAILABLE COVERAGE	
3300 and 3400 Series	
3304	G3304
3306	G3306
3406	G3406
3408	G3408
3412	G3412

3500 Series					
3508	3508	–	G3508	G3508B	–
3512	3512B	3512B	HD G3512	G3512B	–
3516	3516B	3516B	HD G3516	G3516B	G3516C
–	–	–	G3520	G3520B	G3520C
3524	3524B	–	–	–	–
3532	3532B	–	–	–	–

3600 Series	
3606	G3606
3608	G3608
3612	G3612
3616	G3616
3618	–

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Barloworld Equipment CAT

Engine Bearings

- *Aluminium Alloy Bearings (Bi-metal)*
- *Aluminium Alloy Bearings (with overlay)*
- *Copper/Lead Bearings*

Built to protect your engine investment

Bearings play vital roles inside your engine – preventing damage to crankshaft journal surfaces and maintaining correct oil flow and pressure between parts – so installing the correct bearing is critical.

By installing Cat engine bearings, you can prevent damage to expensive engine components, minimise repairs, and maximise uptime.

Three bearing choices optimise system performance

Caterpillar is constantly looking for new and improved engine bearing material and designs to match engine performance demands. The three bearing designs described below offer optimised performance based on variables unique to each engine system.

- Bi-metal bearings feature an advanced aluminium alloy and no overlay, providing more consistent bearing clearance and little wear.
- Aluminium alloy bearings feature aluminium bearing and copper bonding materials to prevent scuffing and corrosion, reducing the chance of failure.
- Copper/lead bearings feature greater fatigue strength, increasing durability and reliability.

Quality construction, extended life, greater protection

Consistent construction means Cat engine bearings deliver maximum performance and life, and provide greater protection for other, more expensive engine components.

Consistent wall thickness: When the main or rod cap is bolted in place, the bearing and crankshaft journal are in close proximity. A film of oil exists between the two components during engine operation to protect them from damage. The consistent wall thickness of Cat bearings ensures that the film of oil is the proper thickness, helping prevent the friction and metal-to-metal contact that can cause excessive wear and premature failure.

Precise crush height: Cat bearings feature precise crush height, which helps ensure proper clearance and contact pressure between the bearing and bore.

Our comprehensive support helps you lower costs

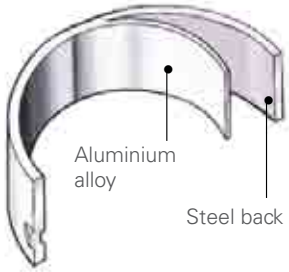
Contact your Barloworld Equipment customer service representative for more information on Cat engine bearings. With Cat parts, you receive the correct bearings to match your system, together with the right technical support for dependable engine system operation.

Cat engine bearings:

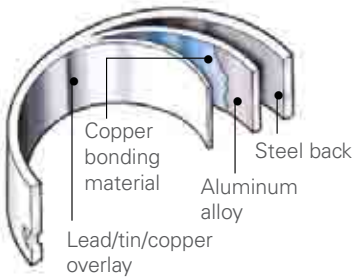
- Feature consistent wall thickness to distribute oil properly.
- Have precise crush height to ensure proper clearance and oil flow.
- Are made of the correct material to optimise performance under varying cylinder pressures.

Engine Bearings

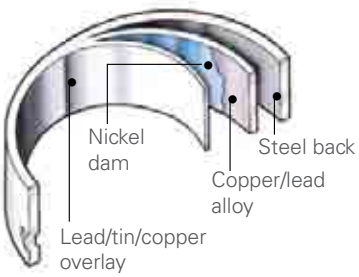
Aluminium alloy bearing
(bi-metal)



Aluminium alloy bearing
(with overlay)



Copper/lead bearing



Cat Pistons, Rings, Liners and Rods

Built to meet your engine's demands

Pistons, rings, liners and rods form the heart of your engine, controlling the combustion process and transferring mechanical energy to the crankshaft.

To protect your engine from harsh conditions, Cat pistons, rings, liners and rods are:

- Designed to work and wear as a system in your Cat engine for smooth, efficient operation and long life.
- Manufactured and tested to close tolerances to ensure top engine performance.
- Heat treated to deliver strength and durability during engine operation.

Quality materials and controlled manufacturing processes also mean Cat piston crowns and connecting rods can be remanufactured for a second life. Cat Reman Cylinder Packs offer same-as-new performance, long life, and quick turnaround, all at a fraction of new prices.

New Cat pistons, rings, liners, and rods are designed and manufactured using quality materials and controlled processes for maximum performance and durability.

One Piece Pistons

- Improved structural capability of the single piece forged steel piston simplifies assembly and eliminates the number of parts.
- New oil jet with higher oil velocity provides more concentrated cooling.
- Reduces thermal expansion and allows piston fit to be tighter for a reduction in cavitation.
- Reduction in surface area provides less friction and helps improve fuel consumption.

Two Piece Pistons

- Two piece 'articulated' design for reduced piston slap, better combustion and reduced emissions due to rings located closer to the top of the piston.
- Steel crown for heat resistance, and higher cylinder pressure.
- Aluminium skirt for weight reduction.

Cat Liners

- Inside surfaces feature a uniform cross hatch pattern for faster ring seating, proper ring seal, uniform oil distribution, and long life.

GENUINE CAT PARTS

Comprehensive service and support

When your engine needs service, our professional technicians have the training and tools to get you back to work quickly. We provide off-the-shelf component availability backed by Caterpillar's worldwide parts network.

- Flanges are roll burnished in the radius for increased strength and resistance to cracking.
- Heat-treated high-grade gray iron construction provides exceptional strength and long life.
- Controlled flange head thickness guarantees a precise match with the block and head.
- Precise manufacturing tolerances ensure perfectly round bores for efficient oil control and proper fit in Cat engine blocks.

Cat Rings

- Precise plasma or chrome plating guarantees exceptionally long wear life.
- Proper surface finish provides smooth operation and long wear life.
- Barrel-faced top ring maintains the proper oil film thickness on the cylinder liner for reduced liner damage and oil consumption.
- Durable heat-treated ductile iron construction resists breaking and impact loading.
- Precise fit with grooves ensures proper oil control and sealing between the crankcase and combustion chamber for efficient operation, long wear life and reduced blow-by.

Chrome Ceramic Ring

- Coating of several layers of hard chromium for higher scuffing resistance.
- A network of tiny micro-cracks on each layer for better thermal fatigue properties.
- Ceramic particles embedded into each layer of chrome improve consistency properties over the entire coating depth.
- Normal chromium wear exposes new ceramic particles resulting in less surface cracking/ring flaking, reduced wear of both ring and cylinder bore, significant life improvement, and better spalling resistance.

Fractured Rod

- Perfectly matched joint surfaces allow rods to accept higher loads.
- Fractured uneven surface helps locate the rod end and cap, eliminating the need for a locating dowel.
- Automatic bolt insertion and fastening equipment ensures the cap and rod stay together, eliminating the possibility of a mismatched cap and rod during material handling.

REMAN CYLINDER PACKS

Remanufacturing transforms used Cat components to new parts standards. When you need repairs, Cat Reman Cylinder Packs will get you back to work quickly, reliably, and affordably. Completely remanufactured to include all critical engineering updates and design improvements, Cat Reman Cylinder Packs provide same-as-new performance and long life.

Strict remanufacturing processes

- New articulated piston bushings are installed using correct installation methods to ensure retention of bushing in bore.
- New liners and rings are installed for exact fit and smooth operation.
- All components are extensively tested and inspected for conformance to factory specifications.

Cat Pistons, Rings, Liners and Rods
Continued

Fast, easy installation

Cat Reman Cylinder Packs contain the cylinder liner, piston, rings, pin, retainers, connecting rod, and all necessary seals. They come preassembled and ready for installation as a unit, reducing your turnaround time.

Plus, our special tooling and repair technique can save up to an hour per cylinder during installation, so it's possible to complete an entire in-frame overhaul in one day. No other engine manufacturer offers this kind of service.

Fully warranted, low-cost repair options

Cat Reman Cylinder Packs are priced at 45-50% of the cost of new parts and offer the same factory-fresh performance. To prove it, Caterpillar backs Reman Cylinder Packs with a same-as-new parts warranty.

Cat engine bearings resist scuffing and friction, prevent corrosion, and ensure proper clearance and oil flow for maximum performance and protection of engine parts.

Cat pistons, rings and liners versus competitor parts

Caterpillar randomly tests competitive parts to determine quality differences. These comparisons consistently reveal the following shortcomings about competitive pistons, rings and liners.

Competitive pistons

- Imprecise fit can cause liner scuffing and piston seizure.
- Partially disbonded ring bands and out-of-spec ring grooves can cause blowby and cylinder damage.

Competitive rings

- Thin chrome plating can reduce wear life.
- Soft, gray iron construction can reduce durability and lead to failure.

Competitive liners

- Lack of heat treating and roll burnishing can lead to flange cracks and breaks.
- Random cross hatch pattern can result in poor oil control and increased oil consumption.

Cat liners are plateau bored for proper mating of piston rings and liner, better oil control and long life.

Pistons, Rings and Liners

Competitive liners are non-plateau bored and require breaking in, producing wear and delays proper oil control.

Quality materials and controlled manufacturing processes ensure Cat pistons, rings, liners, rods and Reman Cylinder Packs deliver top performance and long life.

Firing on all Cylinders

Precious Metals Engine Rebuild Kits

Introducing the Precious Metals Engine Rebuild Kit series for 3176, 3306, 3406, 3406C and 3406E engines

Caterpillar's recently launched Precious Metals Engine Rebuild series comes in pre-packaged kits that contain all the necessary components to effect maintenance interventions at set stages in an engine's working life.

To get machines back to work fast, there are four kit options: Bronze, Silver, Gold and Platinum with all parts enclosed meeting Caterpillar's exacting quality standards.

Bronze covers basic repairs typically caused by factors such as dust ingress, whilst Silver and Gold kits are designed for mid-life top and bottom rebuilds. Platinum kits meet complete rebuild requirements, optimising the second and third life capabilities of Cat engines.

As the basic building block for all higher levels, Bronze includes components that one might not think of replacing, but which could lead to unplanned downtime and costly failures, a prime example being exhaust manifold sleeves.

Bronze components include gaskets and seals; oil and fuel filters; camshaft bearings; turbo nuts and bolts; and a coolant temperature regulator.

Silver builds on Bronze with the addition of pistons, cylinder liners, wrist pins, piston rings and retainers. Gold in turn includes the Bronze kit, plus six Cat Reman cylinder pack assemblies; whilst Platinum incorporates all Gold kit components plus a Cat Reman cylinder head, Reman fuel injectors, and Reman water and oil pumps.

At this stage Precious Metals Engine Rebuild Kits are being introduced locally for 3176, 3306, and 3406, 3406C or 3406E engines. The 3406 series caters for the following machine models:

- Cat 980G and 980F wheel loaders.
- Cat D8N and D8R track-type tractors.
- Cat 735 and Cat 740 articulated trucks.
- Cat 824G wheel dozers.
- Cat 826G compactors; and
- Cat 621G, 623G, 627F and 627G scrapers.

The 3306 rebuild kit caters for models that include:

- Cat 140H and 160H motor graders.
- Cat 966G wheel loaders.
- Cat D7 dozer.

Rebuild It Right. The Right Parts, Right Now.

- **Get more for your money.** Pre-packaged kit options feature improved pricing and contain everything you need for a cost-effective repair solution.
- **Count on quality.** Genuine Cat engine components are manufactured to precise specifications and engineered for a reliable rebuild, boosting productivity and minimising downtime. They work together as a system to give your machine new life.
- **Save time and effort.** Because there's no need to select individual parts for the repair, you always get exactly what you need – no more, no less. That simplifies ordering and handling, shortens turnaround time and reduces the chance for errors.

Firing on all Cylinders

Continued

FIND THE LEVEL THAT'S RIGHT FOR YOU.

BRONZE LEVEL

Features
- Basic building block for all higher levels.
- Includes additional value-add components, such as rod bearings.
- Includes components you might not think of replacing, but that could lead to unplanned downtime and costly failures, such as exhaust manifold sleeves.
- Includes required gaskets and seals to reassemble the engine (out of frame rebuild kit).

Benefits
- Includes all parts necessary for low-cost repair option.
- Ideal for repair before failure.

SILVER LEVEL

Building from the Bronze Level, a cost-effective option for a basic rebuild, the Silver Level includes: new pistons, liners, wrist pins, rings, retainers and a rodless, unassembled cylinder pack.

Features
- Includes Bronze Kit.
- 6 pistons, liners, wrist pins, rings and retainers.
- Rodless, unassembled cylinder pack.

Benefits
- Basic rebuild.
- Where Reman is not a preference.
- Similar consist to aftermarket kits.
- Additional engine components can be ordered as needed.

GOLD LEVEL

Features
- Includes Bronze Kit.
- Includes 6 Cat Reman cylinder pack assemblies.

Benefits
- Basic rebuild.
- Cat Reman cylinder packs are preassembled with connecting rods, pistons, rings, wrist pins and liners, saving four to six hours of labour during engine rebuild.
- Ideal for repair before failure.
- Additional engine components can be ordered as needed.

"Choosing the best engine kit option for each stage in the life of your machines will significantly extend their overall utilisation."

PLATINUM LEVEL

The Platinum Level is the most complete rebuild option; designed to maximise the built-in second and third life of your engine.

Features

- Bronze Kit.
- 6 Cat Reman cylinder packs.
- 6 Cat Reman injectors or fuel nozzles.
- Cat Reman complete cylinder head, water pump and oil pump.

Benefits

- More complete engine rebuild option.
- Preassembled Reman cylinder packs and cylinder head will save additional labour hours during engine rebuild.
- Maximises the built-in second or third life of your engine.
- Additional engine components can be ordered as needed.

Firing on all Cylinders

Continued

ALL YOU NEED TO DO IT RIGHT

Precious Metals Engine Kits come in four levels: Bronze, Silver, Gold and Platinum.
Whatever level you choose, you'll find unmatched value as compared with competitive kits.

	Typical Engine Rebuild Kit Consist Introduced at Each Level*	Genuine Cat Rebuild Kits	Non-Genuine Aftermarket Kits*	Why is this part included in the Cat Engine Rebuild Kit and not by competitors?
BRONZE LEVEL	Camshaft Bearings	✔	✔	
	Drive Gear Bushings	✔	✔	
	Rear Structure Gasket Set	✔	✔	
	Front Structure Gasket Set	✔	✔	
	Head Gasket Set	✔	✔	
	Oil Pan Gasket	✔	✔	
	Fuel Injector Gasket Set	✔		Re-use of injector seals may cause fuel dilution and additional damage to the engine
	Exhaust Manifold Sleeves	✔		Debris from unexpected failure may damage turbo and internal cylinder components
	Oil Pan Isolator Assemblies	✔		Replacement ensures compliance with Emissions and Noise Regulations
	Exhaust Manifold High Temperature Studs	✔		Maximises reliability
	Thermostat	✔		To ensure proper cooling and to prevent engine overheating
	Valve Cover Gear Seal	✔		Replaced to prevent any leaks from when seal was removed
	Advanced Efficiency Oil Filter	✔		Ensures your significant investment is protected
	Advanced Efficiency Fuel Filter	✔		Ensures your significant investment is protected
	Manifold and Turbo Lockouts	✔		Locknuts are not reusable
SILVER LEVEL	Liners	✔	✔	
	Piston Crowns	✔	✔**	Recommended by Caterpillar's engineers to maximise performance and reliability
	Piston Body Skirts	✔	✔	
	Rings	✔	✔	
	Wrist Pins	✔	✔	
	Liner Seals	✔	✔	
GOLD LEVEL	Liners	✔**	✔	
	Piston Crowns	✔**	✔***	Recommended by Caterpillar's engineers to maximise performance and reliability
	Piston Body Skirts	✔**	✔	
	Rings	✔**	✔	
	Wrist Pins	✔**	✔	
	Liner Seals	✔**	✔	
	Connecting Rods	✔**		Recommended by Caterpillar's engineers to maximise performance and reliability
PLATINUM LEVEL	Complete Reman Cylinder Head	✔		Cat Reman parts provide same-as-new performance, improved turnaround time and reliability at a fraction of the cost of buying new parts
	Complete Set of Reman Fuel Injectors	✔		
	Reman Water Pump	✔		
	Reman Oil Pump	✔		

Actual consists may vary according to Engine Model and product options and attachments associated with your engine arrangement
*** As compared with the Silver Level, the Gold Level not only includes Reman Connecting Rods, the cylinder packs are pre-assembled, saving additional labour hours*
**** Aftermarket kits typically require piston crowns to be ordered separately from the kit, depending on engine sales model and kit manufacturer*

Remanufactured Engines and Engine Components

As good as new, as strong as ever

At Barloworld Equipment we stock Cat Reman engines, engine overhaul kits and engine components so we can get you back in operation quickly, affordably, and reliably.

Factory Remanufacturing

Remanufacturing is more than rebuilding. It is a process of returning engines and components to their original performance specifications through the use of state-of-the-art salvage techniques, strict reuse guidelines, advanced manufacturing systems, and unequalled quality control.

Restoring original performance is possible since new Cat engines and engine components are built to be remanufactured for a second life. This attention to detail ensures that Cat Remanufactured engines and engine components provide like-new quality and reliability.

Engines
Cat Reman engines are remanufactured using only Cat parts, many of them new. Engines are upgraded to include critical design improvements. Plus, each engine is dynamometer tested for operational and performance indicators. This ensures that Cat Reman engines meet the same performance specifications as new Cat engines. All blocks are tested electronically to ensure consistent quality and long life.

Generators

Reman generators provide an off-the-shelf solution which helps customers avoid the lengthy processing time required by a generator rewind shop. Reman generators are remanufactured in a factory environment with Cat controlled processes and are tested with the same rigor as a new Cat generator. Reman generators are shipped without a "doghouse" providing more flexibility for your application

Short and Long Blocks

Cat Reman long and short blocks are disassembled, thoroughly flushed to meet rigid cleanliness standards, and 100% inspected for cracks, erosion, or other damage. Block and cylinder head faces are resurfaced to factory specifications. Crankshafts are reground, polished, and checked for lift and endplay. All bearings, seals, gaskets, and piston rings are replaced with new Cat parts. Blocks are tested electronically to ensure consistent quality and long life.

Cylinder Heads

Reman cylinder heads are 100% magnafluxed to detect cracks, erosion or other damage, and are updated to include engineering changes. The bottom deck is resurfaced to ensure a tight seal and to help prevent combustion gas and coolant leaks. All critical wear and sealing components are replaced with new Cat parts. Cat Reman cylinder heads are pressure tested for leaks before they leave the factory.

Air Compressors
Crankshaft and journal surfaces are reground and polished and cylinder bores re-honed to exact dimensions. Each unit has new piston rings, rubber parts, springs, seals, gaskets, and washers to help deliver like-new performance.

Alternators/Starters
To ensure same-as-new performance, all alternator gaskets and seals, and starter O-rings, seals, and boots are replaced.

Crankshafts
Crankshafts are 100% magnafluxed to detect cracks. Crankshaft journals are machined to the same surface finish, roundness, and location tolerance of new crankshafts to extend service life.

Remanufactured Engines and Engine Components

Continued

Cylinder Packs
Cat Reman cylinder packs ensure your engine is overhauled using performance-matched Cat parts. Only Caterpillar preassembles the connecting rod, liner, and piston as a unit, cutting overhaul time by as much as 25%.

ECUs
Cat Reman has developed its own line of remanufactured ECUs. This ensures electronic control units are thoroughly diagnosed and remanufactured, and critical engineering updates are completed. When the remanufacturing process is complete, the units pass through rigorous durability test requirements.

Flywheels
Cat Reman flywheels are balanced to factory specifications with factory surface finish, which means a smoother engine operation and better clutch break-in. Cat Reman also inspects all ring gears and replaces when necessary.

Fuel Injection Pumps and Governor Groups
All gasket seals and worn parts are replaced with new. Each unit is computer-tested for 20 critical quality points to ensure maximum performance and fuel economy.

Oil Coolers
Unlike other rebuilders who clean and reuse bundles, Cat Reman oil coolers use only new tube bundles and end sheets, which increases reliability and performance levels.

Turbochargers
Centre housings are tested for seal integrity. All thrust and antifriction bearings are replaced to ensure long life and performance.

Unit Injectors and Fuel Nozzles
Every component is completely disassembled, cleaned, and extensively inspected to ensure same-as-new quality and reliability. Advanced salvage techniques are applied to ensure components meet specifications. All seals and O-rings are replaced. Fully assembled remanufactured injectors are tested and calibrated to new product specifications.

Water Pumps and Oil Pumps
Cat Reman water and oil pumps are updated to meet the latest design standards and feature 100% replacement of bearings and seals.

Simple core acceptance reduces costs

Cat Reman engine components are typically priced at 40-70% of new with the return of your used core through our easy core acceptance programme.

Our simple core acceptance criteria allow a quick determination of core credit. We visually inspect the core on the spot, providing an immediate decision on core condition and credit, so you don't have to wait for or guess about repair costs. Our two-level pricing system ensures that engines with broken, cracked, or welded blocks can earn a partial refund. Plus, knowing the exchange price in advance means you'll avoid mid-job surprises.

Basic Core Criteria

- Component not visibly cracked, broken or welded.
- Fully assembled and complete.
- No non-operational damage (mishandling, excessive rust, corrosion, or pitting).
- Acceptable part number – Cat part.

Core refund criteria vary by component and are subject to change. Partial core refunds are available for some Cat Reman components. Contact you Barloworld Equipment customer service representative for more information.

Warranties protect your investment

Cat Reman Engines
We have various warranties depending on the sales model and application.

Cat Reman engine components
Cat backs Reman engine components with a same-as-new warranty, honoured worldwide.

Good for the environment

Generous core acceptance reduces cost, reduces waste, keeping non-renewable resources in circulation for multiple lifetimes.

Cat Starters and Alternators

Built to meet your engine's demands

New and remanufactured Cat starters and alternators are built to work together, meeting the demands of your engine and operating environment.

A large amp alternator for a Cat 140K motor grader.

A starter motor for a Cat D10T dozer.

Starters

Cat starters are designed specifically to handle the high current experienced during the cranking of Cat engines. They are built to work hard and deliver reliable performance even in tough, dirty environments.

Caterpillar starters with the PRELUB® system
Cat starters with the PRELUB® system help to prevent the wear caused by dry starts. This innovative starter combines an oil pump with the body of a conventional starter. The pump automatically draws engine oil from the sump and pressurises the engine before allowing the starter to crank the engine. Cat starters with the PRELUB® system can be easily retrofitted to your machine.

(PRELUB® is a registered trademark of RPM Industries.)

Alternators

Cat alternators are divided into two categories: brush type and brushless. Brush type alternators use one-piece brushes and constant pressure springs for even brush wear. Brushless alternators feature tighter air gap tolerances and superior sealing for longer life in dusty, dirty environments. Both alternator types are superior high-output charging systems that are quiet, compact, and lightweight.

Cat Reman starters and alternators reduce downtime and costs

When you need repairs, Cat Reman starters and alternators get you back to work quickly, reliably, and affordably. Completely remanufactured to include the latest engineering updates, Cat Reman starters and alternators provide same-as-new performance and long life.

Caterpillar Starters: Power and Reliability

- Positive-engagement shift mechanism ensures precise pinion-to-ring gear engagement.
- Seamless one-piece solenoid case protects against corrosion.
- Rotatable drive housing allows flexible mounting.
- Brush holder provides constant spring pressure for even wear.

Starters crank your engine to starting RPM while alternators supply electrical power to operate electrical attachments and/or accessories.

Cat Starters and Alternators
Continued

Strict remanufacturing processes

- Components are stripped down to the piece parts.
- New O-rings, seals, bushings, and bearings are installed.
- Rewound coils are sealed with new insulation.
- Heat sink compounds are replaced.
- All components that cannot be remanufactured to Caterpillar specifications are replaced with new parts.
- Each part is checked individually, and the finished product is performance tested to ensure it meets like-new specifications.

Coverage and availability

Cat Reman starters and alternators are available off-the-shelf for nearly all Cat engine applications. Coverage includes Cat Reman starters with the PRELUB® system, as well as a wide amperage range of alternators (up to 145 amps).

Fully warranted, low-cost repair options

Cat Reman starters and alternators are priced at 40-50% of the cost of new parts and provide same-as-new performance and long life. To prove it, Caterpillar backs Reman starters and alternators with a same-as-new parts warranty.

Caterpillar Alternators

- Built-in electronic voltage regulators.
- High-efficiency cooling system.
- Brushless design for harsh environments.

AN EASY WAY TO INCREASE EFFICIENCY. CAT® CERTIFIED USED.

For more information contact our call centre on 0800 21 22 48 or visit www.barloworld-equipment.com

Barloworld Equipment CAT

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KEEP IT REAL, KEEP IT CAT®

For more information contact our call centre on 0800 21 22 48 or visit www.barloworld-equipment.com

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LONGER LIFE. LOWER COSTS.

KEEP IT REAL. KEEP IT CAT®

CAT® PRECIOUS METALS ENGINE REBUILD KITS

Rebuild your engines to run not just longer, but longer at peak performance. With four levels of Precious Metals Rebuild Kits, you can choose one that meets your rebuild needs and your budget.

For more information contact our call centre on 0800 21 22 48 or visit www.barloworld-equipment.com

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PREVENTATIVE MAINTENANCE AND FLUIDS

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Fuel Contamination Control

An Introduction

Contamination control is increasingly important for maximising performance and service life in fuel systems. Some Cat fuel systems exceed pressures of 30 000 psi in order to deliver more horsepower, better fuel economy and fewer emissions. This necessitates tolerances smaller than five microns between parts. These tolerances and injection pressures make fuel systems more vulnerable to wear and abrasion.

- ***Injector nozzles:*** Contaminants move quickly in high-pressure systems, causing damage, eroding orifices and resulting in incomplete atomisation of fuel and over-fuelling. This harms performance and fuel economy. Contaminants also result in hard starts and increased emissions. Larger contaminants can actually clog orifices.
- ***Injector plungers and barrels:*** Abrasive particles cause wear between an injector's plunger and barrel. Contaminants scuff metal surfaces, causing metal-to-metal contact and eventual injector seizure.
- ***Control valves:*** contaminants damage valves that control fuel pressures, eroding mating parts of the valves. This excessive wear causes leaks and eventual loss of engine power.

Size of Contamination

A particle five microns across can damage fuel systems. A micron is one millionth of a metre. To give you an idea of how small that is, an average human hair is 80 microns in diameter. Tolerances in Cat fuel injectors are 1/20th the diameter of a human hair. It's easy to understand how even small contaminants can damage today's fuel systems.

Sources of Contamination

- ***In the fuel:*** Contaminants can enter during storage or transportation of fuel. A reliable supplier; filtered dispensing; and periodic sampling and testing ensure consistent quality.
- ***During operation:*** Airborne particles can be drawn into your fuel tank through the vent tube. A fuel tank vent can ingest dust when it is not properly sealed.
- ***External:*** Contamination can enter during maintenance and service, even when changing filters.

Filtering Contamination

The precision components in today's fuel systems require specially designed fuel filters.

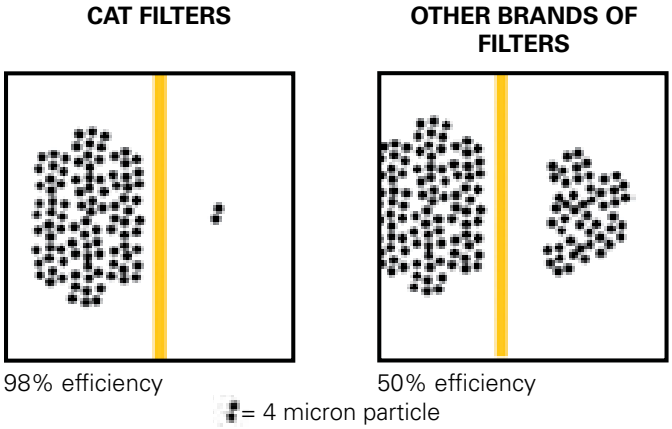
Cat advanced high efficiency fuel filters use exclusively designed filtration media to remove more than 98% of particles, four microns in size and larger. These Cat fuel filters feature:

- Spiral roving and acrylic beads to maintain pleat stability and spacing to better trap and hold contaminants.
- A non-metallic centre tube for strength and to prevent metal contamination.

Measuring Contamination

Contamination is measured by counting particles and reported by comparing those results to an International Standards Organisation (ISO) code. This ISO standard refers to the number of particles in three different size categories contained in a one-millilitre sample. The first number refers to the number of particles that are greater than 4 microns, the second number refers to particles that are greater than 6 microns, and the third number refers to particles that are greater than 14 microns.

An ISO level of 18/15/13 would mean that a one-millilitre sample of fuel contains ISO Code 18 or between 1300-2500 particles greater than 4 microns, ISO Code 15 or between 160-320 particles greater than 6 microns, and ISO Code 13 or between 40-80 particles greater than 14 microns. If the contamination level is allowed to rise one ISO Code, the amount of particles for that size will double.



Abrasive particles cause wear between an injector's plunger and barrel.

Bulk Fuel Filtration Strategies

Understanding the importance of coalescence

During laboratory analysis of a diesel engine injector valve seat, the results of poor fuel management practices are clearly discernable under microscopic conditions. Here the evidence of inadequate contamination control procedures is exposed in the form of moderate to severe scouring damage caused by water and debris ingress.

Left unchecked, this invisible threat will steadily erode individual machine and overall fleet performance, increasing downtime and pushing up owning and operating costs.

Some Cat fuel systems, for example, exceed pressures of 30 000 psi in order to deliver more horsepower, better fuel economy and fewer emissions, which necessitates tolerances smaller than five microns between parts. Where contamination is present, these tolerances and injection pressures make fuel systems more vulnerable to wear and abrasion.

However, this potentially underlying problem can be countered efficiently by installing a bulk filtration system that forms part of a strict contamination control programme, since clean dry fuel is essential in order to achieve long injector life.

As part of its solutions offering, Caterpillar supplies bulk fuel filtration plants in various litre flow rate configurations that are designed to help maintain fuel to 18/16/13 per ISO 4406 (or below 4 micron). These bulk filtration units are positioned along the supply pipeline between the fuel storage tank and fuelling station. They have the capacity to remove 3% continuous free water-in-fuel by volume to less than .01% at the rated flow of the unit.

At the heart of the Cat bulk filtration process is the coalescer vessel, which contains multiple elements. Pre-filter elements remove dirt and particulate debris; the coalescer elements then strip water from the fuel.

Due to the high flow rate of fuel through the coalescer elements, flow forces will cause some small water droplets to be washed off the coalescer's hydrophilic filter fibres. The separator canisters fit over the coalescer elements and prevent these droplets from escaping to the outlet of the coalescer vessel, so there is no chance of water contamination.

Naturally, these filtration systems are not designed to clean heavily contaminated fuel: a good portion of water and dirt can routinely be removed from supply fuel by using proper storage tank settling and draining practices.

Most of the remaining water and dirt can then be removed by using Cat bulk filtration or adding filtration and water separation capacity to each machine in the fleet.

Failure to maintain clean fuels that meet or exceed 18/16/13 (per ISO 4406) will lower fuel system reliability and engine performance.

The Cat bulk fuel filtration system is intended for use in any application where users store fuel for machines or engines. Smaller Cat filtration units are intended for remote day tank or fuel truck applications.

HOW IS FUEL CLEANLINESS MEASURED? (18/16/13 PER ISO 4406)		
ISO Code	**18**	**16**	**13**
Particles > 4 microns		
Particles > 6 microns		
Particles > 14 microns		
Range Numb	**Micron**	**Actual Particle Count Range (per ml)**
18	4+	1,300 – 2,500
16	6+	320 – 640
13	14+	40 – 80

BULK FUEL FILTRATION UNITS
Flow rate capacities
50 GPM
100 GPM
200 GPM
300 GPM

Fuel Management

ISO 4406 CHART		
Range Number	Number of particles per ml	
	More Than	Up to and including
24	80,000	160,000
23	40,000	80,000
22	20,000	40,000
21	10,000	20,000
20	5,000	10,000
19	2,500	5,000
18	1,300	2,500
17	640	1,300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	.64	1.3
6	.32	.64

Critical points when it comes to fuel

- Use fuels that satisfy all the performance requirements of Cat Fuel Specification, ASTM D975 or equivalent.
- Fill machine or engine fuel tanks with fuel that meets or exceeds 18/16/13 cleanliness level per ISO 4406.
- Change fuel filters per service requirements (typically every 500 hours).
- Drain water separators daily in accordance with the operating and maintenance manual (O & MM); and
- Drain fuel tanks of sediment every 500 hours or three months per the O & MM.

Genuine Cat® parts - Find them on line!

Keep it Real. Keep it Cat® For more information contact our call centre on 0800 21 22 48 or visit www.barloworld-equipment.com

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Barloworld Equipment CAT

Cat Fuel Water Separators and Primetime™ Priming Pumps

Advanced High Efficiency Fuel Water Separators

Diesel fuel acts as a lubricant in unit injectors. The film strength of diesel fuel prevents metal to metal contact between the plunger and barrel. Water can compromise film strength, resulting in scuffing and eventual seizure.

Cat fuel water separators have best in class water removal capabilities essential for better protection of unit injectors. Cat fuel water separators also deliver longer secondary fuel filter life.

These Cat fuel water separators:
- Remove more than 98% of debris 10 microns and larger.
- Virtually eliminate free water in fuel.
- Remove 87% of dissolved water.

PrimeTime Priming Pump

Cat PrimeTime priming pumps are easily installed on the frame or engine as retrofits. They prime the filter and fuel system with a flip of the switch.

The benefits:
- No need to pre-fill the filter and risk debris reaching injectors.
- Primes the fuel filter in two to six minutes.
- No time-consuming, difficult manual pumping.

While these two products are available separately, you will get the best results when they are used together.

Retrofit Information

Axial seal filters are designed to retrofit engines in the field while radial seal filters have an exclusive Cat design for improved sealing performance on new engines. Both will upgrade the durability and water removal performance over previous Caterpillar offerings and other brands.

Check the collection bowl daily and drain as needed.

EASY TO INSTALL PUMP

Electric priming pump works with the flip of a switch, priming in two to six minutes.

Resilient mounting extends pump life and absorbs some of the shock load.

Primary fuel filter removes more than 98% of debris 10 microns and larger.

Water separator removes virtually all free water and 87% of dissolved water from diesel fuel.

Reusable water collection bowl has capacity of 90ml, is transparent for easy monitoring and drains in less than one minute.

"Protect your fuel system and extend the life of unit fuel injectors: un-dissolved water quantities greater than .1% can cause major damage."

Fuel Management

Cat Non-Pressurised Fast Fill Fuel Kits

Faster, safer, more accurate filling

Now there are non-pressurised fast fill fuel kits available for Cat and non Cat equipment. These easy-to-install kits do not depend on a traditional pressure sensing nozzle to shut off fuel flow, but instead rely on a valve to control fuel shut-off.

Cat Non-Pressurised Fast Fill Fuel Kits can be used to retrofit existing pressurised fast fill systems or added to machines without fast fill provisions.

Better technology for better results

Environmentally Friendly

- Prevents over/under-filling of tank (does not rely on the automatic nozzle for shut-off).
- Provides tank fill with greater accuracy.
- Improves contamination control through a closed loop system.
- Incoming air is now filtered through a separate breather, allowing for cleaner fuel.
- Closed vent lowers the risk of fuel spilling during severe operations, side slope and rollover conditions.

Reduced Costs and Maintenance Time

- Eliminates pressure in the fuel tank.
- Fast refuelling rates up to 150 GPM. Fills in 1/10th of the time over standard gravity fill rates.
- Minimises fuelling downtime.
- Eliminates need to drain fuel tank for receiver servicing.
- Improved vent performance, resulting in less risk of fuel leaks.

Safer Work Environment

- Ground-level fuelling eliminates dangerous climbs to reach the fuel cap on the top of the tank.
- Fuel tank is not pressurised during nozzle shut-off.
- Shut-off levels are consistent.

Durable Components

- Vent and inlet valve have a long life.
- Receiver connects to industry-standard fuel nozzles.

Models

- Off-Highway Truck/Tractor 769D; 773E; 776D; 777D.
- Articulated Truck 725; 730; 730 Ejector; 735; 740; 740 Ejector.
- Excavator 385B; 385C; 5090B; 5110B; 5130B.
- Quarry Truck 771D; 775E.
- Wheel Dozer 844; 844H; 854G; 814F.
- Wheel Loader 980H; 988G; 988H; 990 Series II; 990H; 992G; 994F; 994D.

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Barloworld Equipment CAT

Fast Fuel Conversion Kits

Flange-mounted receivers reduce fuel leaks and contamination

It's now faster and easier to change fast fuel receivers. That's because Caterpillar offers kits to convert Cat or Wiggins fast fuel threaded receivers to flange-mounted units. So now many old or new Cat machines equipped with fast fuel systems can benefit from greatly simplified field changes and a reduced risk of fuel leaks.

- ***Less thread damage:*** because threaded receivers can be installed and removed several times a year, the tank port threads can become worn or damaged. This results in both fuel leaks and fuel contamination. With flange-mounted fast fuel receivers, worn receivers can be changed without replacing the reusable steel adapter…and without damaging the tank port threads.
- ***No special tools:*** a common Allen wrench easily removes and installs four bolts to change flange-mounted fast fuel receivers.
- ***Two conversion kits:*** one conversion kit is available for threaded receivers on Cat fast fuel systems and another kit is designed for threaded receivers on Wiggins fast fuel systems.

Installation just got easier

- ***Easy access.*** A 10 mm Allen wrench removes the four bolts holding the two split flanges, so removal and installation can be performed with less clearance. There's no more need for large, cumbersome wrenches in tight conditions, as is the case when changing threaded receivers.

- ***Compatibility.*** Cat flange-mounted fast fuel receivers are compatible with existing Wiggins and other brands of fuel system nozzles without degradation of fuel flow or fuel nozzle shut-off valve performance. The fuel tank adapter accepts Cat flange-mounted fast fuel receivers and mounting flanges where space permits.

Convert Cat or Wiggins fast fuel threaded receivers to flange-mounted receivers.

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Barloworld Equipment CAT

Oil Safe Containers

Protect fluid quality, reduce contamination

Recognise this?

Poorly stored fluids can become contaminated and will lead to accelerated component wear, robbing equipment of efficiency.

Oil Safe Way

- Protects fluids from contamination.
- Prevents spills from open containers.
- Reduces accidents.
- Allows easy access to hard to reach locations.
- Durable.
- Manual flow rate control.

Fluid Contamination

Oil exposed to air immediately becomes contaminated.

Poorly stored fluids will become contaminated and will lead to accelerated component wear, like:

- Shortened component and fluid life.
- Catastrophic failures and costly downtimes and repairs; and
- Reduced productivity.

System efficiency can drop 20% before the operator detects a problem. That's a loss of one day per week.

Features and Benefits

- Available in 5 sizes: 1.5L, 2L, 3L, 5L, and 10L.
- Interchangeable lids and drums.
- Sold separately or in a kit.
- Vent control with button in handle.
- Quick twist spout is easy to open and close; it controls flow rate and keeps dirt out.
- Semi-transparent cylinder with graduated markings makes liquid levels easy to see.
- Durability tested:
  - Withstands extreme temperatures ranging from -40°(F) to 176°(F).
  - Flash Point at 340°C.
  - Manufactured from High Density Polyethylene (HDPE) incorporating anti-static agents and ultraviolet (UV) stabilisers.

It only takes a half teaspoon of dirt to contaminate a 55 gallon drum of fluid.

Cat GO

Gear oil for Cat manual transmissions, differentials and final drives (SAE 80W-90, SAE 85W-140)

Cat GO is a multi-grade API GL-5 classification gear oil intended for extreme-pressure applications, such as the following:

Differentials and final drives on Cat wheel tractor-scrapers, specific articulated trucks, wheel excavators, and backhoe loaders.

Cold Planer direct drive transmissions, differentials, and final drives.

Drum bearings on vibratory soil compactors.

Discover the Difference

Cat GO is tested and approved by Caterpillar to meet the same high standards as Genuine Cat Parts.

- ***Longer gear and bearing life:*** superior thermal stability and oxidation resistance reduce deposits and wear.
- ***Extreme pressure performance:*** provides extra protection for improved performance and life in extreme-load conditions.
- ***Simplified maintenance:*** multi-purpose capability reduces number of gear lubricants needed for maintenance.
- ***Wide temperature range:*** provides excellent stability at high temperatures and superior performance at low temperatures for easier start-ups.

TYPICAL CHARACTERISTICS*		
SAE Viscosity Grade	80W-90	85W-140
Gravity, API (ASTM D287)	26.6	25.1
Flash Point, °C (°F) (ASTM D92)	210 (410)	230 (446)
Pour Point, °C (°F) (ASTM D97)	-27 (-17)	-18 (0)
Viscosity		
cP @ -26° C (ASTM D2983)	110,000	N/A
cSt @ 40° C (ASTM D445)	139	333
cSt @ 100° C (ASTM D445)	14.5	25.4
Viscosity Index (ASTM D2270)	104	99
Phosphorus, % wt. (ASTM D1091)	0.087	0.087

** The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.*

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Barloworld Equipment CAT

Cat DEO™

Diesel engine oil for world wide application (except North America)

SAE 15W-40, SAE 10W-30

Recommended Use

- Cat earthmoving, commercial, marine* and on-highway truck diesel engines.
- Low-emission diesel engines including Cat engines with ACERT® technology.
- Heavy-duty diesel engines made by other manufacturers that recommend API CI-4, CH-4 or CG-4 classification oil. (Please refer to the "Typical Characteristics" table for more information.)
- Automotive gasoline engines that require API SL classification oils.

** Excluding 3126 and 3116 MUI Marine and MaK diesel engines. The 3116 and 3126 MUI Marine diesel engines with closed crankcase ventilation systems should use Cat SAEO™.*

Discover the Difference

Cat DEO is developed, tested and approved by Caterpillar to meet the same high standards as all Genuine Cat Parts.

- Used as standard factory-fill for Cat machines.
- ***Increased Engine Life:*** Resists oxidation and prevents build-up of deposits on pistons and rings.
- ***Extended Drain Intervals:*** Extends oil drain intervals while providing excellent engine protection and performance when used in conjunction with the S•O•S Services oil analysis programme.
- ***Proven Performance:*** Tested thoroughly in Cat diesel engines including Cat engines with ACERT Technology to ensure excellent engine life and performance.
- ***Long-Lasting Protection:*** Improved soot control and enhanced shear stability enable oil to maintain proper viscosity for longer operating periods in Cat engines with ACERT technology, especially those equipped with HEUI systems.

Cat DEO Performance

This table indicates the differences between ECF-2 standards and the proprietary standards of Caterpillar.

Performance Requirements	Test	Commercial ECF-2	Cat DEO
Cat 3406E Endurance Test	Cat Proprietary		
Cat C13 ACERT Endurance Test	Cat Proprietary		
Cat 3500 Series Test	Cat Proprietary		
Cat C13 ACERT Series Wheel Loader Test	Cat Proprietary		
C13 500 Hour Engine Test			
Improved Soot-Viscosity and Shear Control			
High Temperature Shear			
Elastomer Compatibility			
Piston ring and Cylinder liner wear			
Valve train wear, sludge, oil filter plugging			
Aeration Control			
Bearing Corrosion			
Cam roller follower pin wear			
Copper, lead and tin erosion			
Foaming Control			
Viscosity Shear loss			
Viscosity Increase from soot			
Oxidation			
Piston deposits and oil control			

Tested Beyond Industry Standards

In addition to the tests required for the ECF-2 classification, Cat DEO undergoes four proprietary multi-cylinder endurance tests, a variety of quality assurance tests and thousands of hours of field service. Only when it has passed all these tests can it be approved by Caterpillar.

Cat DEO™
Continued

TYPICAL CHARACTERISTICS*			
	SAE Viscosity Grade	15W-40	10W-30**
API Service Classification:	Diesel	CI-4, CH-4	CI-4, CH-4
	Gasoline	SL	SL
ACEA Classifications		E5/B3/A2	
OEM Performance Level:	Caterpillar	ECF-2	ECF-2
	MB	228.3	
	MAN	3275	
	Volvo	VDS-3	VDS-3
	RVI	RLD	
	Cummins	CES 20071/72/76/77	CES 20071/76/78
	Mack	EO-M PLUS	EO-M PLUS
Flash Point, °C (ASTM D92)		230	222
Pour Point, °C (ASTM D97)		- 30	- 36
Viscosity: cSt @ 40° C (ASTM D445)		103	76
cSt @ 100° C (ASTM D445)		14.2	11.5
Viscosity Index (ASTM D2270)		135	144
Sulfated Ash, % wt. (ASTM D874)		1.3	1.3
TBN (ASTM D2896)		11.3	11.3
Zinc, % wt. (ASTM D4951)		0.146	0.146
Gravity @ 16° C: API (ASTM D287)		29.3	31.3
	Specific	0.880	0.869
* The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.			
**Not available in all regions.			

PRODUCTIVITY THAT GIVES YOU THE CUTTING EDGE®

Caterpillar has a seamless range of continuous miners covering both soft- and hard-cutting applications in any seam thickness. The range includes machines capable of operating in seams from 0.76 m to 4.70m
- Less downtime through Longer Overhaul Intervals
- Superior performance via higher output engine
- High maneuverability allows faster positioning and optimum cutting

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Barloworld Equipment CAT

Cat DEO™ Monograde

Monograde Diesel Engine Oil for Cat 3600 Series Diesel Engines

SAE 30, SAE 40

Recommended Use

- Cat DEO Monograde is the only oil approved by Caterpillar for use in 3600 series diesel engines operating on distillate diesel fuels.
- Cat DEO Monograde is recommended for older Cat engines equipped with pre-combustion fuel injection systems that permit the use of American Petroleum Institute CD or CF oil.
- Cat DEO Monograde can be used with low-sulphur diesel fuel and protects Cat engines operating on higher sulphur diesel fuels (3600 series engines operating on fuel containing up to 1.30% sulphur, and pre-combustion engines operating on fuel containing up to 0.065% sulphur fuel).

Discover the Difference

Cat DEO Monograde is developed, tested and approved by Caterpillar to meet the same high standards as Genuine Cat Parts.

- Used as standard factory-fill for Cat 3600 series diesel engines.
- ***Increased engine life:*** Resists oxidation and prevents build-up of deposits on pistons and rings.
- ***Longer intervals*:** Extends oil drain intervals while providing excellent engine protection and performance when used in conjunction with the S•O•S Services oil analysis programme.
- ***Proven performance:*** Tested in Cat 3600 series diesel engines worldwide.

TYPICAL CHARACTERISTICS*		
SAE Viscosity Grade	30	40**
API Classification	CF***	CF***
CCMC	D3	D3
Manufacturer Tests		
Caterpillar (engine)	1M-PC	1M-PC
Allison (transmission)	C-3	C-3
Gravity, API (ASTM D287)	26.8	26.2
Flash Point, °C (ASTM D92)	234	234
Pour Point, °C (ASTM D97)	-33	-33
Viscosity:		
cSt @ 40°C (ASTM D445)	103	133
cSt @ 100°C (ASTM D445)	11.6	13.8
Viscosity Index (ASTM D2270)	100	100
Sulfated Ash, % wt. (ASTM D874)	1.9	1.9
TBN (ASTM D2896)	13.0	13.0
Zinc, % wt. (ASTM D4951)	0.119	0.119
Phosphorus, % wt. (ASTM D1091)	0.106	0.106

** The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.*

*** Passes FZG DIN 51354-2 A/8, 3/90 FLS 12*

**** Can be used in applications where the obsolete API CD classification oil is recommended*

Sulphur-level compatibility

Cat DEO Monograde provides excellent performance and protection for the following Cat engines operating at or below these fuel sulphur levels:

- 3600 Series Direct Injection 1.30%.
- Pre-combustion 0.65%.

For higher fuel sulphur content, an S•O•S Services oil analysis programme is recommended to optimise oil drain intervals.

Tested Beyond Industry Standards

The large-bore, medium-speed Cat 3600 engines require oils that meet a unique standard not defined by any industry classification. Cat DEO Monograde meets that proprietary Caterpillar standard. If other brands of lubricant are used instead of Cat DEO, the manufacturer must demonstrate that the oil meets the same standard.

S•O•S Services for early problem detection
Protect your investment with Cat S•O•S Service, the ultimate detection and diagnostic tool for your equipment. S•O•S helps you detect potential problems before they can lead to major failures and costly, unscheduled downtime.

Cat Filters: Complete protection for your equipment
Combine Cat Fluids with Cat Filters for the highest level of contamination control and protection for your equipment. We recommend Cat Filters for all Cat equipment applications.

Cat MTO

Tractor oil for multi-application use in older Cat backhoe loader rear axles and Cat Challenger™ tractors

Recommended Use

Recommended for older Cat backhoe loader rear axles and Cat Challenger tractors, Cat MTO can also be used in the following applications:

- Cat components and systems recommending multipurpose tractor fluid that meet Ford/New Holland M2C134D specification.
- Most Cat hydraulic systems.
- Other manufacturers' machines and components. (Please refer to the "OEM Compatibility" table.)

Discover the Difference

Cat MTO is developed, tested and approved by Caterpillar to meet the same high standards as Genuine Cat Parts.

- ***Improved braking and clutching:*** Where approved for use, MTO enhances control and extends life in clutches and wet brakes.
- ***Lower maintenance costs:*** Exceptional anti-wear properties extend equipment and component lives.
- ***Cold-weather operation:*** Can be used in temperatures as low as -25°C.
- ***Simplified maintenance:*** Can be used in multiple compartments, reducing inventory and the chance of using the wrong oil.
- ***Long-lasting performance:*** Offers high thermal stability and oxidation resistance for long service life in severe applications.

TYPICAL CHARACTERISTICS*	
Gravity, API	28.6
Flash Point, °C (°F) (ASTM D92)	214 (417)
Pour Point, °C (°F) (ASTM D97)	-42 (-44)
Viscosity	
Brookfield, cP at –20°C	4300
cSt @ 40°C (ASTM D445)	58
cSt @ 100°C (ASTM D445)	9.3
Viscosity Index (ASTM D2270)	140
Zinc, % wt.	0.15 min.

** The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice*

OEM COMPATIBILITY	
Cat MTO meets the following OEM specifications:	
API	GL-4
CNH	MAT3525
Ford New Holland	FNHA-2-C-201.00
Kubota	UDT
Volvo	WB 101/BM
Cat MTO can be substituted in applications that require the following:	
Agco Powerfluid	821 XL
Allison	C4 (Agriculture Applications Only)
Denison	HF-0/HF-1/HF-2 (T5D and P46)
Ford	ESN-M2C 134 D
JI Case	MS 1204-07/09
John Deere	JMD J20C
Massey Ferguson	MF 1135/1141
Vickers	35VQ25

"Combine Cat fluids and Cat filters for the highest level of contamination control and protection for your machine."

NGEO™ Advanced 40

For natural gas engines requiring low-ash oil (SAE 40)

Cat NGEO Advanced 40 oil is designed for specifications that provide superior lubrication performance in low-emission, high-output, four-cycle engines using natural gas fuel. Cat NGEO Advanced 40 has been tested and approved by Caterpillar to meet the same high standards as Genuine Cat Parts.

Customer Benefits

- ***Reduced Piston and Cylinder Wear:*** Anti-oxidant and anti-nitration properties prevent deposit buildup to minimise scuffing, scoring, and wear.
- ***Increased Spark Plug and Valve Life:*** Excellent detergent and dispersant additives protect against deposits and damage.
- ***Corrosion Protection:*** Acid neutralisers protect parts from rust and copper corrosion.
- ***Extended Drain Intervals:*** Provides extended oil drain capabilities when using the Cat S·O·S Services oil analysis programme.
- Comparable viscometric properties as Cat NGEO EL 250 and EL 350. All are SAE 40 grade oils.

Recommended Uses

The oil may be used in engines that use high-sulphur gas, provided that shorter drain intervals are employed. NGEO Advanced 40 is formulated from select base stocks blended with special additives to provide:

- Excellent anti-oxidation/nitration properties.
- Thermal stability.
- Reduced carbon and sludge formation.

TYPICAL CHARACTERISTICS*	
SAE Viscosity Grade	40
Gravity @ 16°C	
API (ASTM D287)	28.4
Specific	0.885
Flash Point, °C (ASTM D92)	252
Pour Point, °C (ASTM D97)	-12
Viscosity	
cST @ 40°C (ASTM D445)	115
cST @ 100°C (ASTM D445)	13
Viscosity Index (ASTM D2270)	95
TBN, mg KOH/g (ASTM D2896)	6
Sulfated Ash, % wt (ASTM D874)	0.50
Phosphorous, % wt (Spectro or AA)	0.030
Calcium, %wt (Spectro or AA)	0.130

** Values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.*

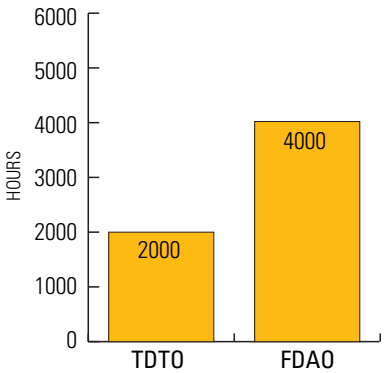
Cat FDAO™

Final drive axle oil for off-highway trucks, large track-type tractors, pipe layers and track skidders (SAE 60)

TYPICAL CHARACTERISTICS	
Viscosity Grade	
SAE	60
ISO	320
Caterpillar Test	FD-1
Gravity, 16° C	
API (ASTM D287)	25.9
Specific	0.899
Flash Point, °C (°F) (ASTM D92)	255 (491)
Pour Point, °C (°F) (ASTM D97)	-15 (5)
Viscosity	
cSt @ 40° C (ASTM D445)	334
cSt @ 100° C (ASTM D445)	25.2
Viscosity Index (ASTM D2270)	97
Brookfield Viscosity	
cP @ -10° C (ASTM D2983)	75 000
Copper Strip (ASTM D130, 2 hrs @ 100° C)	1A

** The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.*

RECOMMENDED DRAIN INTERVALS*
(Cat Final Drives for Off-Highway Trucks)



** Possible with S•O•S Services*

Recommended Use

- The preferred lubricant for Cat off-highway truck front wheels, differentials and final drives. Recommended drain intervals are at around 4 000 hours for off-highway trucks as determined by S•O•S Services.
- Preferred lubricant for Cat large track-type tractor, pipe layer, and track skidder final drives (steel-tracked machines with elevated final drives except the D5M, D6M and 561M).

Compatible with Cat final drives and axles that previously specified TO-4 lubricants and do not contain friction material.

Discover the Difference

Cat FDAO is developed, tested and approved by Caterpillar to meet the same high standards as Genuine Cat Parts.

- Used as standard factory-fill for Cat off-highway trucks and large track-type tractors.
- Extended drain intervals: Allows for double-length drain intervals in off-highway truck final drives, as compared to TO-4 commercial oils.
- Minimal foaming: formulated to protect against the damaging effects of air.

Cat TDTO™

Transmission and drive train oil for Cat transmissions, final drives and wet brake compartments (SAE 10W, SAE 30, SAE 50)

Recommended Use

- The preferred lubricant for Cat power shift transmissions, and most final drives and wet brake compartments.
- Cat machine compartments where TO-4 and TO-4M specification oils are recommended.
- Other manufacturers' machines that recommend TO-4 or TO-4M or specification oils for their transmissions, final drives and wet brake compartments. (Please refer to the "Typical Characteristics" table.)

Tested Beyond Industry Standards

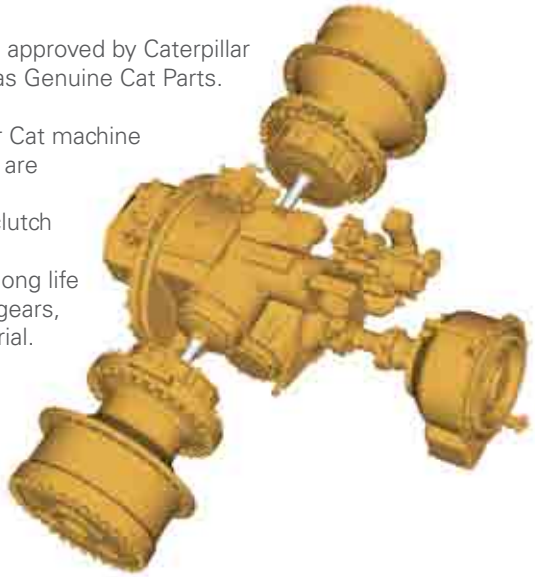
The TO-4 specification defines a minimum standard of performance for transmissions and drive train oils, but Cat TDTO is required to pass five additional Caterpillar tests.

It is only through these tests and thousands of hours of field experience that Caterpillar is confident in saying Cat TDTO will deliver long life and excellent performance when used in Cat transmissions and final drives.

Discover the Difference

Cat TDTO is developed, tested and approved by Caterpillar to meet the same high standards as Genuine Cat Parts.

- Used as standard factory-fill for Cat machine compartments where TO-4 oils are specified.
- ***Longer Clutch Life:*** Prolongs clutch disc life up to 45%.
- ***Optimum Wear Life:*** Ensures long life and excellent performance for gears, bearings and friction disc material.
- ***System-Matched Formula:*** Engineered as an integral part of Cat power shift transmissions, most wet brake compartments, and hydrostatic systems.



TYPICAL CHARACTERISTICS			
SAE Viscosity Grade	10W	30	50
Caterpillar Test	TO-4	TO-4	TO-4
Allison Test	C-4	C-4	C-4
ISO Viscosity Grade	46	100	–
Gravity, API (ASTM D287)	29.7	27.0	24.7
Flash Point, °C (°F) (ASTM D92)	202 (395)	224 (435)	240 (464)
Pour Point, °C (°F) (ASTM D97)	-33 (-27) min	-18 (0) min	-15 (5) min.
Viscosity			
cP @ –25° C (ASTM D5293)	6840	–	–
cSt @ 40° C (ASTM D445)	42.0	100	195
cSt @ 100° C (ASTM D445)	6.3	11.2	18.0
Viscosity Index (ASTM D2270)	97	97	96
Calcium, % wt.	.298	.298	.298
Zinc, % wt. (ASTM D4951)	.127	.127	.127
Phosphorus, % wt. (ASTM D4951)	.110	.110	.110
Sulfated Ash, % wt. (ASTM D4951)	1.2	1.2	1.2
TBN (ASTM D2896)	7.9	7.9	7.9

** The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.*

I keep my fleet red. I keep it Cat®

You have to push every day. To meet tomorrow's deadline. To secure the next contract. To stay ahead of the competition. No matter what challenges lie ahead, Caterpillar and Barloworld Equipment are committed to bringing you machines, solutions and support to help your business keep pushing forward. **SAFETY BUILT IN.**

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Cat NGEC™

Natural Gas Engine Coolant
(Premix 50/50)

Prevents Freezing While Providing Superior Component Protection

Cat NGEC (Natural Gas Engine Coolant) is a heavy-duty cooling system fluid designed to prevent freezing and boiling while providing superior component protection.

NGEC is approved for use in all Cat natural gas and diesel engines, as well as in most diesel, gas or natural gas engines made by other manufacturers (when following OEM recommendations).

Benefits

Performance
Cat NGEC protects the cooling system of your natural gas engine over a temperature range of -37°C to 129°C. Additional freeze protection can be gained when the coolant concentration is raised to 60%.

Cat NGEC contains inhibitors that provide superior protection for metal components, especially aluminium, against pitting and corrosion. The formulation of Cat NGEC minimises the formation of foam.

Ready-To-Use
Cat NGEC is premixed with de-ionised water and embitterment. No supplemental coolant additive is needed.

Cat NGEC Provides Top Component Protection

Aluminium can be a very difficult metal to protect from corrosion and cavitation (boiling) damage. Cat NGEC is formulated to provide excellent protection for all metals used in cooling systems. In testing (ASTM D2809) with aluminium water pumps, Cat NGEC demonstrated its superior ability to protect compared to competitive heavy duty coolants.

Drain Interval

When used in Cat natural gas engines and properly maintained with Cat SCA, Cat NGEC has a drain interval of three years. Refer to the Operation and Maintenance Manual of your specific machine/engine for drain intervals based on service hours.

S•O•S Fluid Analysis Services for Early Problem Detection

Protect your investment with Cat S•O•S Coolant Analysis, the ultimate detection and diagnostic tool for your engines. Refer to the Caterpillar Operation and Maintenance Manual for the recommended intervals of S•O•S Level 1 Coolant Analysis (e.g. every 250 hours). Level 2 Coolant Analysis is recommended at least annually for all Cat engines and machines.

Testing Nitrite Levels

Field testing of coolant nitrite levels can be performed using the 4C-9301 test kit. Results are immediate and SCA additions can be made as needed.

Coolant Maintenance Resources

For in-depth information on coolant maintenance, refer to your Barloworld Equipment customer service representative.

TYPICAL CHARACTERISTICS[1]	
ASTM Specification	ASTM D6210
Colour	Magenta
BOILING PROTECTION – 15 PSI (1 BAR) RADIATOR CAP	
50% Cat NGEC/50% water	129°C
60% Cat NGEC/40% water[2]	132°C
FREEZE PROTECTION	
50% Cat NGEC/50% water	-37°C
60% Cat NGEC/40% water[2]	-52°C
pH (50% solution)	10.5
Nitrite (50% solution)	1,200 ppm
Molybdate (50% solution)	310 ppm
Silicon (in the form of silicates) (50% solution)	120 ppm
Phosphate	0 ppm

[1]The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.

[2]Higher levels of glycol reduce the heat transfer performance of the coolant. For optimum performance, Caterpillar recommends a 50/50 percent mix of Cat NGEC and water, unless additional freeze protection is required.

Formulated to meet or exceed the following ASTM standards: D3306, D4985, D6210, TMC RP302, and TMC RP329.

Cat ELC

Extended Life Coolant for Cat and original equipment manufacturer (OEM) diesel and gasoline engines (50/50 Premix)

Recommended Use

Cat ELC meets or exceeds the requirements of the following specifications and guidelines:

- Cat EC-1 • TMC RP-329 • TMC RP-338.
- ASTM D-3306 • ASTM D-6210 • SAE J1034.

Cat ELC also meets the performance requirements of Cummins, Detroit Diesel, International, Mack and Volvo.

Discover the Difference

Cat ELC is developed, tested and approved by Caterpillar to meet the same high standards as all Genuine Cat Parts.

- Used as standard factory-fill for all Cat machine cooling systems.
- ***Lower Maintenance Costs:*** Reduces engine coolant and additive costs by as much as 500% compared to conventional coolants. It eliminates the need for supplemental coolant additives, extends coolant change-out intervals and reduces disposal requirements.
- ***Advanced Metal Protection:*** Incorporates an advanced formula technology with organic acid additive corrosion inhibitors, such as a combination of mono and dicarboxylates for maximum protection of copper, solder, brass, steel, cast iron and aluminium.

TYPICAL CHARACTERISTICS*	
Colour	**Strawberry Red**
Boiling protection with 15 psi (1 bar) radiator cap	
50% Cat ELC/50% water	129°C
60% Cat ELC/40% water (ELC concentrate added)	132°C
Freezing protection	
50% Cat ELC/50% water	-37°C
60% Cat ELC/40% water (ELC concentrate added)	-52°C
Nitrite (50% solution)	500 ppm
Molybdate (50% solution)	530 ppm
**The values shown are typical values and should not be used as quality control parameters to either accept or reject product. Specifications are subject to change without notice.*	

CAT DEAC™

3 000 Hour Life or
333 000 km

Cat Supplemental Coolant Additives Every 250 Hours or 25 000 km

CAT ELC (Machines and Commercial Engines)

Cat Extender Every 6000 Hours*

12,000 Hour Life or 6 Years**
(whichever comes first)

CAT ELC (Truck Engines)

Cat Extender Every 500 000 km*

1 000 000 km or 6 Years**
(whichever comes first)

** Or one-half of the coolant service life.*
*** These coolant change intervals are only possible with annual S•O•S Level 2 coolant sampling and analysis.*

S•O•S Services for early problem detection

Protect your investment with Cat S•O•S Coolant Analysis, the ultimate detection and diagnostic tool for your equipment. We recommend S•O•S Level 1 Coolant Analysis according to the engine's Operation and Maintenance Manual, and Level 2 Coolant Analysis annually for all your Cat equipment.

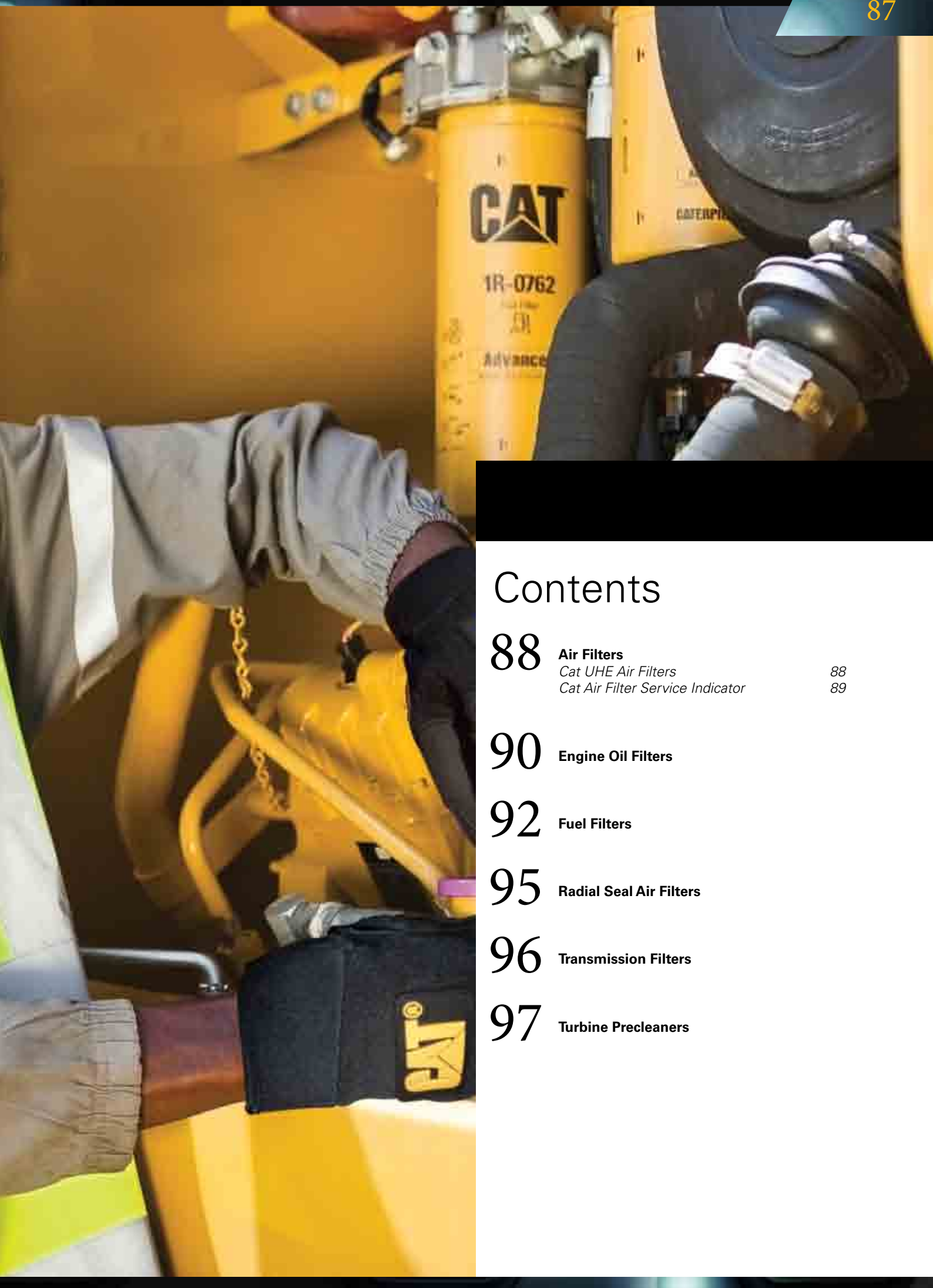
Cat ELC Extender for Longer Life

- Exceeds Cat EC-1 performance requirements.
- Protects against cylinder liner/block pitting and cavitation erosion.
- Should be added at 500 000 km for Cat powered on-highway trucks and 6 000 hours for commercial engines.
- Extender is only necessary once during the life of the coolant.
- Ensures Cat ELC performance to 1 000 000 km or 12 000 hours.

Cat ELC Extender and Flush Intervals

Cat ELC Extender should be added after 6 000 hours or 500 000 km of operation, and the system should be drained and flushed with clean water after 12 000 hours or 1 000 000 km. No cleaning agents are needed. If S•O•S Services are used regularly, safe operation with Cat ELC may extend beyond 12 000 hours.

FILTERS



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Cat UHE Air Filters

Early filtration efficiency provides longer engine life

Cat UHE (Ultra High Efficiency) air filters feature a unique surface that extends filter life up to six times that of standard filters and benefits engine life. Caterpillar engineers its UHE air filters to provide best protection for your engine components.

So-called "dirty" filters can be more efficient than new ones because dust cake build-up on the surface actually increases filtration. Designed with this concept in mind, UHE air filters feature a unique media. This media has a very fine synthetic surface layer that covers the entire outside diameter of the filter. Here's how it works:

- Fine particles (dust, heavy carbon/coal dust, soot, talc, etc.) immediately cake on the surface, quickly making the filter very efficient. Less dust gets to the engine, improving fuel economy while reducing wear and maintenance costs.
- Surface particle cake is more porous than dust-coated media, causing less restriction during filter life to improve capacity, engine performance, and fuel economy. In tests, air flow restriction through UHE air filter media increased at a lower rate than five other major brands.
- Because particles get trapped in the build-up on the surface of UHE air filters, the media stays permeable longer– unlike filters with standard media, which become dust-filled deep inside. This extends filter life and filtration efficiency up to six times that of standard media. Extending filter change intervals also means the engine will be exposed to less dust over its life.

Avoiding excessive dust on the job site may not be possible. Avoiding damage the dust can cause is possible with Cat UHE air filters.

If only I had used Genuine Cat® parts!

KEEP IT REAL. KEEP IT CAT®

You have to push every day. To meet tomorrow's deadline. To secure the next contract. To stay ahead of the competition. No matter what challenges lie ahead, Caterpillar and Barloworld Equipment are committed to bringing you machines, solutions and support to help your business keep pushing forward. SAFETY BUILT IN. **For more information contact our call centre on 0800 21 22 48 or visit www.barloworld-equipment.com**

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Barloworld Equipment CAT

Cat Air Filter Service Indicator

Getting the longest life from your air filters

Equipment filters working in low dust conditions last longer. Since it is not possible to visually determine when a filter reaches capacity, changing air filters too soon can result in unnecessary labour and filter costs. Conversely, in highly contaminated air, you may need to change filters earlier than scheduled to ensure full airflow and engine power. You'll know exactly when to change your air filters when you use the Cat Air Filter Service Indicator.

In applications where there is a high percentage of fine dust particles or high amounts of exhaust soot, Cat UHE Air Filters will improve early filtration and provide longer engine life.

- ***Reduced engine wear:*** Particles collect on the filter's surface layer of very fine fibres, quickly building a cake that allows less dust to reach the engine.
- ***Higher efficiency:*** UHE filters are at peak efficiency when brand new. This surface particle cake is more porous than dust-coated media fibres, causing less restriction throughout the filter life.
- ***Better engine performance and fuel economy:*** The lower restriction allows the engine to "breathe" more easily, and fuel economy improves because it takes less power to pull in air.
- ***Longer filter life:*** The unique surface helps extend air filter life up to six times as long as standard filters, limiting filter changes and the chance of contamination during service.

Limits Filter Changes and Saves Money

A Cat Air Filter Service Indicator can often save eight filter changes when in a cleaner environment for 6 000 operating hours.

	Number of Changes	
	Without indicator*	**With indicator**
Primary Filter	24	18
Secondary Filter	8	6
Total	32	24

** When changing the primary element at 250 operating hours and the secondary element at 750 operating hours.*

The Benefits

- Shows you how much filter life remains and ensures optimum engine performance.
- Minimises filter changes and reduces filter costs.
- Indicates airflow resistance even when the machine is not running.
- Can be reset with the spring-release button.

Accurate and easy to read

It is impossible to visually determine when a filter has reached capacity. Instead, the Cat Air Filter Service Indicator accurately reads a filter's condition.

This reading indicates a clean filter element. Readings may vary with system design.

Checking for Accuracy

The air filter service indicator will help you avoid changing filters too frequently which wastes filter life, costs money and unnecessarily introduces contaminants. To make sure the service indicator is operating properly, Caterpillar recommends changing it once a year. It should be checked every 250 hours in normal conditions or daily if dust is severe.

As the filter element fills with dust and soot, the indicator moves up the calibrated gauge to show the exact percentage of filter life remaining.

There are two steps to check the operation:

- ***Reset:*** The indicator should reset within three pushes.
- ***Yellow Core Movement:*** After the engine accelerates to high idle, the yellow core should latch at or near the highest vacuum attained during the acceleration test.

If the indicator will not easily reset or not latch at the highest vacuum level attained, the indicator should be replaced.

This reading shows the filter is no longer allowing sufficient air into the engine and must be changed.

Cat Advanced High Efficiency Engine Oil Filters

Improved filtration for a cleaner engine

Cat Advanced High Efficiency engine oil filters increase contamination control performance providing for a much cleaner running engine lubrication system. Cat Advanced oil filters provide enhanced filtration without the shorter change intervals often required by other brands' higher efficiency filters.

The Cat 1R-1807 and 1R-1808 filters contain an improved, higher efficiency filter media. This media is designed to increase contaminant capturing efficiency while maintaining excellent dirt holding capacity characteristics.

The Cat 1R-1807 and 1R-1808 filters offer better filtration efficiency than standard oil filters, improved engine cleanliness and a longer component life.

An option for improved engine oil filtration

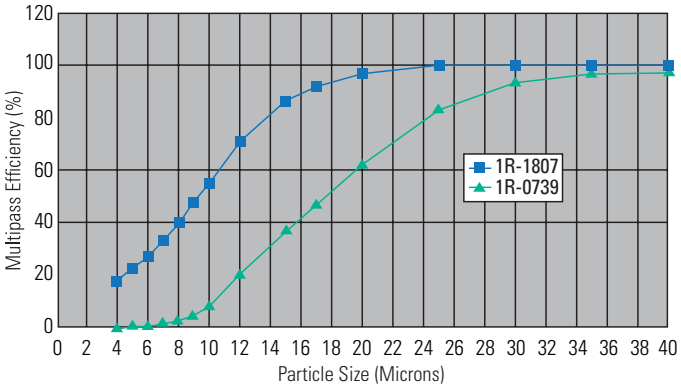
Cat Advanced oil filters are now installed on new engines in production. They are also the approved upgrade option for Cat engine models that use the 1R-0739 and 1R-0716 Standard Efficiency Engine Oil Filters.

Improved filtration for less wear

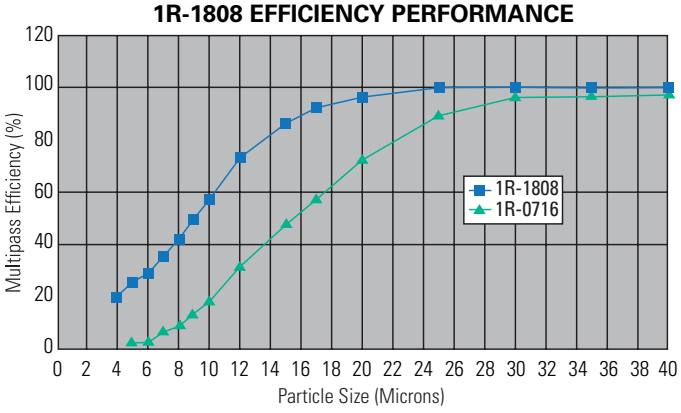
To increase contamination control capability, the Cat Advanced Oil Filter combines improved filtration efficiency, excellent contaminant holding capacity and low pressure drop characteristics.

The graphs to the right demonstrate in blue the improved filtration efficiency the 1R-1807 and 1R-1808 filters offer over the corresponding standard efficiency filters. The result is less wear on oil lubricated engine parts.

1R-1807 EFFICIENCY PERFORMANCE



1R-1808 EFFICIENCY PERFORMANCE



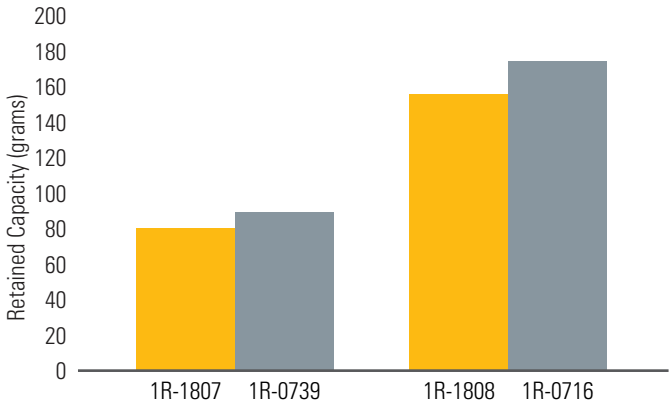
Consistent quality from filter to filter: Caterpillar engineers its liquid filters to avoid metal contaminants, leaks, pleat bunching and movement.

Negligible impact on contaminant holding capacity

The Cat Advanced Oil Filter provides improved filtration efficiency with little effect on dirt holding capacity. Therefore, the condition of the oil as determined by S•O•S Services analysis, and not filter capacity, is the major factor in determining the recommended oil change interval.

The bar graph below illustrates the relative dirt holding capacity of the Advanced Filters and corresponding Standard Efficiency Filters.

CATERPILLAR ADVANCED HIGH EFFICIENCY OIL FILTER
DIRT HOLDING CAPACITY PERFORMANCE



Improved efficiency with minimal loss in reserve capacity and no impact on recommended change interval.

Cat Ultra High Efficiency Fuel Filters

Maximum engine performance, maximum engine life

Cat Ultra High Efficiency (UHE) fuel filters provide unsurpassed contamination control to ensure that only clean fuel reaches your engine. Clean fuel is important because diesel engines now have advanced designs and emissions reduction technologies that use fine tolerances between parts, and pressures up to 30 000 psi. Under these conditions, even smaller, micron-sized contaminates can cause premature component wear, reduced performance, and/or emissions compliance issues.

Unsurpassed component protection: With the ability to capture particles four microns in size and smaller, Cat UHE fuel filters trap and hold contaminates to provide the protection necessary to achieve the designed life of components.

Maximise engine performance: High filtration efficiency is important because contaminated fuel can rob your engine of its rated power and cause hard starts.

Easier serviceability: Cat UHE fuel filters have a positive stop, so they can't be over-tightened, and, in most cases, can be changed without the need for tools. Less maintenance time means more uptime.

Lower cost: The filter housing is reusable so only the cartridge needs to be changed. Less waste is created which reduces disposal costs.

Reliable emissions reduction performance

Cat engines are equipped with after-treatment devices that lower emissions levels. Filters are an important part of this emissions treatment process. The primary and secondary fuel filters work together to remove nearly all contaminates and water before combustion.

It is important to use the correct filter for each and every change because using the wrong filter can jeopardise the performance of the emissions reduction system, taking your engine out of emissions compliance as a result.

Fuel systems are sensitive to damage by contaminates carried in diesel fuel. To minimise this type of damage, Cat UHE fuel filters are designed to maintain a tight separation between the "dirty" and "clean" sides of the filter. All the fuel is forced through the media, where more than 98% of the particulates four microns in size and larger are captured, before entering the clean side.

CAT FUEL WATER SEPARATOR

The Cat Fuel Water Separator removes more than 98% of the particles 10 microns in size and larger, while removing virtually all the free water and 87% of the dispersed water. This is important because with the fine tolerances between parts in today's engines, diesel fuel acts as a lubricant. Removing the water also eliminates the biggest source of pitting damage to fuel injectors.

- Sub-ten micron efficiency
- Reusable housing
- Integrated seals
- Easy-disposal element

Reusable Housing: A reusable housing reduces waste and disposal costs.

Clean Drain Valve: The patented Clean Drain Valve lets you drain the fuel before removing the filter. The valve also locks the filter in place and makes it possible to change the filter without using tools.

CAT SECONDARY FUEL FILTER

Next, the Secondary Fuel Filter removes more than 98% of the remaining particles down to four microns in size. Testing has shown that the filter remains highly efficient with particles below four microns in size as well.

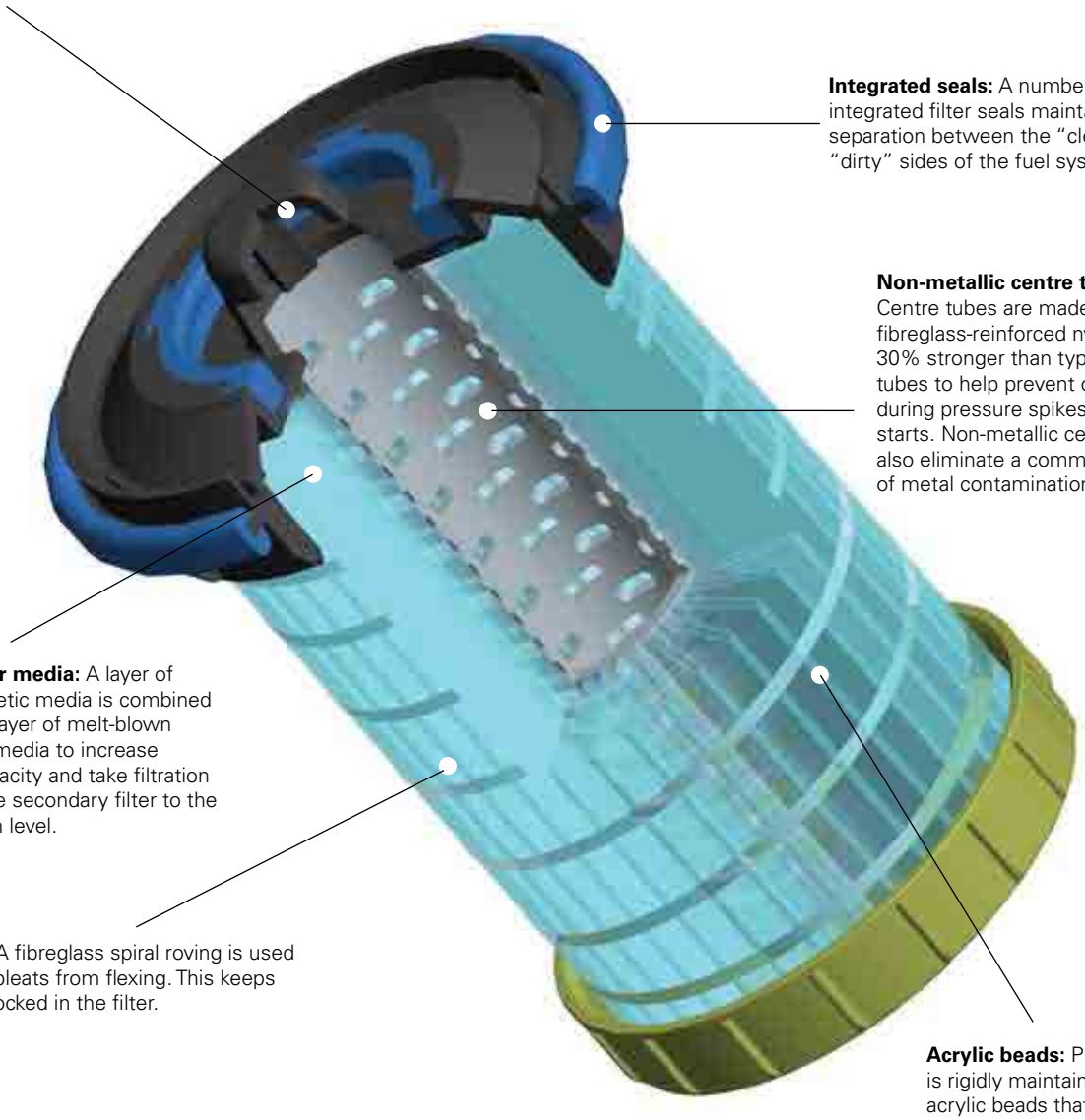
- Sub-ten micron efficiency
- Reusable housing
- Integrated seals
- Easy-disposal element

Supporting Sustainable Progress

Cat Filters help support your sustainability efforts. The filter housing was designed for the life of the machine, reducing waste. The element can be incinerated after use. And because the correct filter is used change after change, your machine continues to operate at its designed levels of performance.

FILTER STRUCTURE: THE ESSENTIAL INGREDIENTS

Prefill deterrent: The top end cap prevents dirty fuel from entering the clean side of the fuel system, even during prefill.



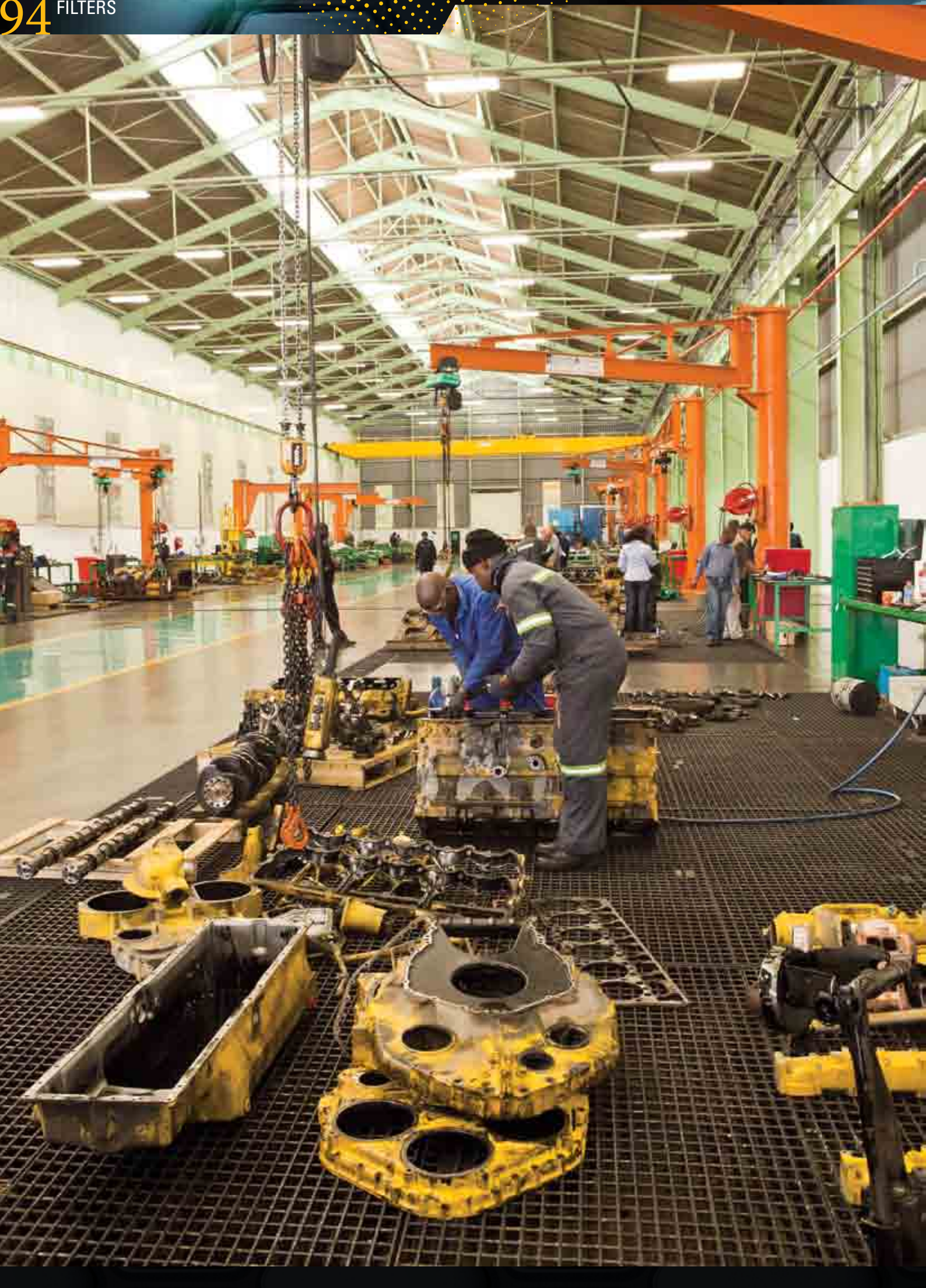
Integrated seals: A number of integrated filter seals maintain a tight separation between the "clean" and "dirty" sides of the fuel system.

Non-metallic centre tube: Centre tubes are made out of fibreglass-reinforced nylon that is 30% stronger than typical metal tubes to help prevent collapse during pressure spikes and cold starts. Non-metallic centre tubes also eliminate a common source of metal contamination.

Advanced filter media: A layer of cellulose/synthetic media is combined with a second layer of melt-blown polypropylene media to increase dirt-holding capacity and take filtration efficiency of the secondary filter to the sub-four micron level.

Spiral roving: A fibreglass spiral roving is used to prevent the pleats from flexing. This keeps contaminants locked in the filter.

Acrylic beads: Pleat spacing is rigidly maintained by acrylic beads that prevent bunching and provide maximum filtration surface area throughout the life of the filter.



Cat Radial Seal Air Filters

Larger capacity, longer service life and lower costs.

This rugged filter has all of the outstanding features of other Cat air filters and more.

It provides up to 50% more capacity for longer service life, and one-piece urethane end caps for a more consistent bond to the filter media. A more reliable seal permits quick servicing with no tools required.

Radial seal filters feature a special adapter ring that can be easily retrofitted to most existing equipment. Once the ring is in place, installation is fast and easy so you spend less time on routine maintenance.

Cat radial seal filters are the best value on the market, with standard filter elements for normal duty and ultra high efficiency elements for extremely dusty and high soot conditions.

Air filter structure and benefits

- **Radial seal design:** No tools are required so service times and maintenance costs are minimised.
- **All steel adapter ring:** Most new Cat machines leave the factory with Radial Seal Air Filters installed. Most older machines can be easily converted with a retrofit adapter ring. It quickly bolts into position to accept the new filter design.
- **One-piece moulded urethane end caps:** Forms a tough, reliable, corrosion proof bond to paper media. Up to 30% more seal contact area for a seal that is more reliable than conventional elements.
- **Densely pleated filter paper:** Large media area provides superior capacity without impeding airflow.
- **Built-in pleat support and positive pleat spacing:** Prevents pleat bunching and ensures optimum filter media surface area.
- **Heavy-duty metal inner and outer wrap:** Increases structural strength and durability.
- **Baked-on enamel outer filter wrap:** Creates a corrosion resistant filter wrap.

Get 100% of filter life

Use the Cat Air Filter Service Indicator to get an accurate, continuous reading of how much life remains in your filter. The easy-to-understand graduated readings let you change the filter only when needed. Over-servicing and under-servicing are eliminated, so you get the lowest possible cost per hour. Contact your Barloworld Equipment customer service representative about retrofit options on most Cat machines.

Change filters without tools and take advantage of up to 50% more capacity with Cat radial seal air filters.

Radial seal filters feature a special adapter ring that can be easily retrofitted to most existing equipment.

KEEP IT REAL, KEEP IT CAT®

For more information contact our call centre on 0800 21 22 48 or visit www.barloworld-equipment.com

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Cat Transmission Filters

Filters designed specifically for transmission and powertrain oil applications.

A line of Cat filters has been introduced to better meet the specific needs of transmission applications. These new Cat transmission filters feature a synthetic media designed to deliver a high level of filtration performance and to reduce pressure drop across the media. The end result: significantly higher dirt holding capacity and better cold weather performance.

Caterpillar recommends Cat Advanced High Efficiency Transmission Filters for transmission applications because they are designed to meet the specific needs of the powertrain.

Switching to these new filters greatly increases filter life and provides better transmission component protection. Cat Transmission Filters perform better in cold weather, and during cold starts instances of filter bypass are greatly reduced, especially when using higher viscosity oils.

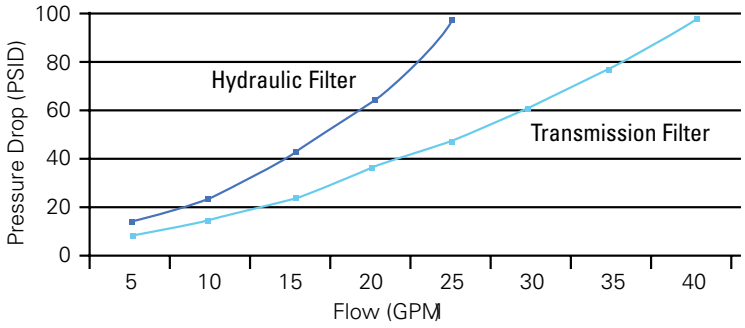
System and Performance Benefits

- Greater dirt holding capacity for longer life.
- A filtration efficiency matched to the needs of transmission applications.
- Reduced pressure drop across the media.
  - Better cold weather performance.
  - Fewer instances of filter bypass.
- Improved protection for sensitive electronic control valves.

Improved Transmission Performance

The test results below demonstrate that Cat Advanced High Efficiency Transmission Filters with synthetic media reduce pressure drop issues in comparison to hydraulic filters with synthetic media. This means reduced bypass and less wear of transmission components.

Pressure Drop
(30W Oil at 62˚F)



Did you know...

That Cat oils have specially formulated additives that play multiple roles in protecting diesel engine systems? These additives act as…

A detergent: keeping all hot parts of the engine clean.

A dispersant: keeping undesired particle elements in suspension until the next scheduled oil drain interval.

An anti-wear system: protecting main components against wear caused by friction.

A rust inhibitor: to protect against corrosion caused by sulphur elements.

An anti-corrosion barrier: to avoid corrosion of metallic parts.

An anti-oxidant: to counter potential oxidation of the oil.

A VI improver: to keep viscosity stable when temperatures change.

An anti-foaming agent: to avoid foam in the oil.

All oils are not equal and don't perform in the same manner.

It's important to make sure the right fluid is in the engine…both type and brand.

Cat Turbine Precleaner

Three times the filter life means less maintenance downtime

Air filter life is directly related to the amount of debris ingested through the engine air intake. Installing a Cat Turbine PreCleaner as the first stage of an air intake system prevents nearly all of the heavier-than-air particles from entering the system, which results in longer air filter life, more efficient engine performance, and decreased maintenance expenses.

Benefits

Significantly lower owning and operating costs.

- Lowers cost per operating hour because cleaner air means longer filter life.
- Lowers air restriction, which increases useable horsepower and improves fuel economy.
- Three times filter life with a reduction in labour, parts, and downtime.

No routine maintenance requirements

- Debris is immediately ejected from the unit, so no cleaning is required.

Built to last

- Rugged polymer construction gives the strength of steel with the light weight of plastic.
- Sealed bearing cavity eliminates wear due to moisture or corrosion.
- No spot welds that will break over time.

Features

Pre-screen eliminates clogs: The inlet pre-screen on the underside eliminates clogs and jams by preventing any debris larger than the ejection slot from entering the precleaner.

Internal strakes (angled fins on sidewall) catch debris in outer orbits and channel the debris horizontally to the ejection slot.

Toroidal dome: The shape enhances the separation process by preventing debris from being sucked in through the ejection port. Debris is ejected and clean air continues to rise, until the dome shape folds it and sends it into the engine air intake.

Rotor technology: Large rotor arm cross-sectional area ensures that the rotor will not snap under load when impacted with mixed debris fields like wood chips, chaff, or small rocks. The rotor accelerates the airflow to improve the separation process and curved swept arms sling debris to the outer orbits of the toroidal dome.

Exclusive sealed bearing cavity: Bearings are packed in a 20% grease concentration – instead of the typical 10-15% used by competitors – to allow operation in extreme cold. The bearings are protected with a labyrinth seal, an o-ring seal, and a top cap to keep debris and moisture out.

Debris-laden applications may require an optional heavy debris basket screen as shown on this Cat 953D unit.

Breakaway technology: The dome is designed to break away from the base if heavily impacted by an obstacle on the jobsite. This feature prevents costly damage to the engine air intake system.

Heavy debris screen kits: Kits are available for debris-laden applications, such as landfill, forestry, etc.

Recommended Uses

Air flow range: Eight models in sizes that range from 3" to 8" to handle 50 – 1 400 cubic feet per minute (CFM), and much higher CFMs with multiple-unit installations. (Please contact your Barloworld Equipment customer service representative for more information.)

Mounting and equipment types: Mounts on all vertical and horizontal air cleaner housings, on all machines.

Recommended uses: Construction, mining, forestry, landfills, farming, military and more.

Debris types: Expels all types of mixed debris, including mud, snow, rain, leaves, sawdust, chaff, dust, etc. Debris-laden applications may require an optional Heavy Debris Basket Screen.

Cat Turbine Precleaner
Continued

Online savings calculator

Make your own cost-saving case study with the Cat Turbine PreCleaner online Savings Calculator.

www.cat.com/parts/precleaner

Enter your own data and costs to see how much time and money the Cat Turbine PreCleaner can save you each year.

How it works:

Step 1: Air and debris pass through a pre-screen on the underside, entering the unit through recessed vanes underneath the particle accelerator blades.

Step 2: The curved particle accelerator blades force air and debris into the sidewall.

Step 3: Strakes (angled fins) along the interior surface move heavier-than-air debris towards the ejection slot, where it is expelled back into the atmosphere.

Step 4: Clean air continues to spin upward, until it is compressed and folded. The clean air is then forced down into the engine air inlet pipe.

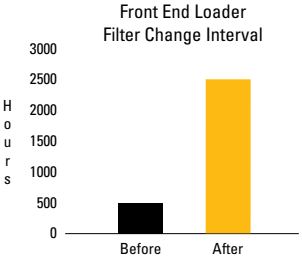
Field installation kits make it easy: The precleaner fits directly onto the engine air inlet pipe. Adapter kits are available if reduction, expansion, or extension is needed.

Case Studies

Five times filter life with concrete dust

Location: Ready-mix plant, FL, USA
Machine: Medium wheel loader
Test period: 5 000 hours

Before precleaner installation, filters were blown-out every 250 hours (not recommended) and changed every 500 hours in accordance with the planned maintenance schedule.

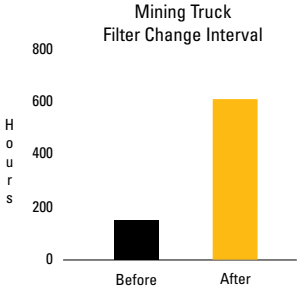


After precleaner installation, only two filters were used during 5 000 hours of operation. The filters were never blown out and were only changed when the restriction gauge indicated a change was necessary.

Four times filter life improvement with quarry dust and debris

Location: Rock quarry in England
Machine: 777D large mining truck with dual air filters
Test Period: 2 000 operating hours

Before precleaner installation, both filters were changed every 150 hours and blown out every 60 hours. Filters were changed when the restriction light came on.



After precleaner installation, both filters were changed at 610 hours, even though there was no restriction indicated by the signal light.

BRAKING SYSTEMS

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Cat Friction Material

The type of friction material your equipment requires is based on machine size and application. Heavy-load applications like mining, for example, require friction material with different functional properties than cycling applications like construction.

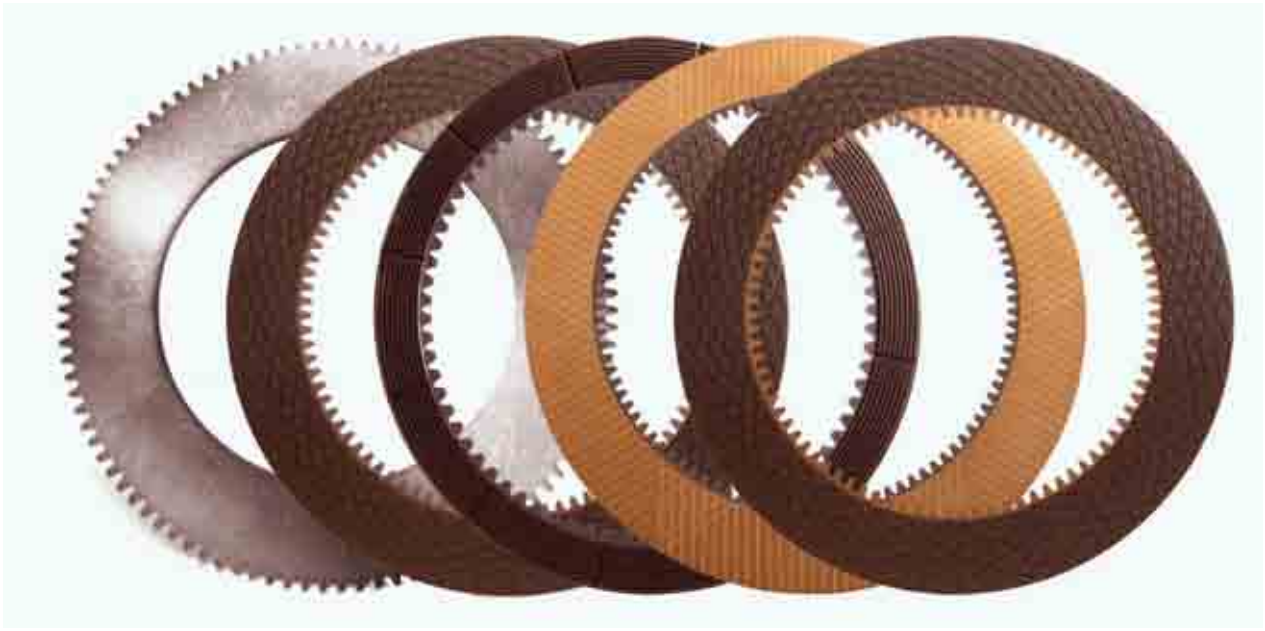
Caterpillar engineers match the characteristics of friction material to the function it performs, the equipment in which it operates, and the fluids and other components used in that system.

Total system design helps ensure safe performance, balanced component life, and maximum parts reusability.

Built to perform in Cat machines

Components made with Cat friction material allow proper fluid flow and heat dissipation, resulting in longer life and lower maintenance costs than other brands. That's why it's critical to select Cat components when it's time to choose replacement brake, transmission, and steering parts.

Only Cat friction material is proven to deliver long, reliable performance in Cat machines. Caterpillar provides reusability guidelines so you know what is required for servicing, another way we help you manage your owning and operating costs.



Separator Plate **Extended Life** **Elastomeric** **Paper** **Bronze**

FRICTION MATERIAL USES		
	Machines	**Applications**
Paper	Off-highway trucks	Brakes
	Wheel loaders	Transmission clutches
	Track-type tractors	Steering clutches
Bronze	Track-type tractors	Brakes
Elastomeric	Off-highway trucks	Transmission clutches
	Wheel loaders	
Extended Life	Off-highway trucks	Brakes
	Wheel loaders	
Separator Plate	All machines	All applications
Using genuine Cat friction material ensures your parts are designed for the best performance, safety, and reliability.		

Built to last, even under incredible stress

Drive train components operate under incredible stress and their ability to stand up to tough conditions can mean significant cost savings. The friction material used in Cat components is designed to last until regularly scheduled assembly overhauls. Its life is better matched to that of other drive train components, so you can make all repairs and replacements at once, minimising repair costs and downtime.

Genuinely Better

Cat friction material is designed just for Cat drive train components working in Cat machines.

Here are a few examples of problems that can be avoided by using Cat friction material:

Material selection

- Unapproved adhesives can result in poor bond strength or premature bond failure.
- Improper density, weight, hardness, thickness or composition can affect braking and shifting and cause premature wear, noise, drag, creep, and damage to the mating part in the system.

Heat treatment

Improper heat treat can cause premature spline wear and damage to the mating part.

Manufacturing processes

- Improper forming of materials can cause misalignment, premature wear, and power overloading.
- Improper groove type, width, and depth can affect oil flow and cooling, resulting in higher running temperatures, loss of coefficient of friction, wear, glazing, and discolouration.
- Improper positioning of the friction material on the core can interfere with the mating part.
- Failure to conform to Caterpillar specs for blanking, tooth shaping, and broaching can create improper fit, resulting in premature failure and damage to the mating part.

Stress relieving

Lack of or improper stress relieving can cause premature wear, warping of the separator plate, and damage to the mating part.

Surface finish and cleaning

- Improper surface preparation can result in poor bond strength with the core, resulting in partial or complete separation from the core plate.
- Poor surface finish can result in accelerated wear on the friction disk, as well as noise, creep, drag, and reduced coefficient of friction.
- Failure to remove loose material can clog fluid filters and affect fluid flow, resulting in poor lubrication and higher running temperatures.

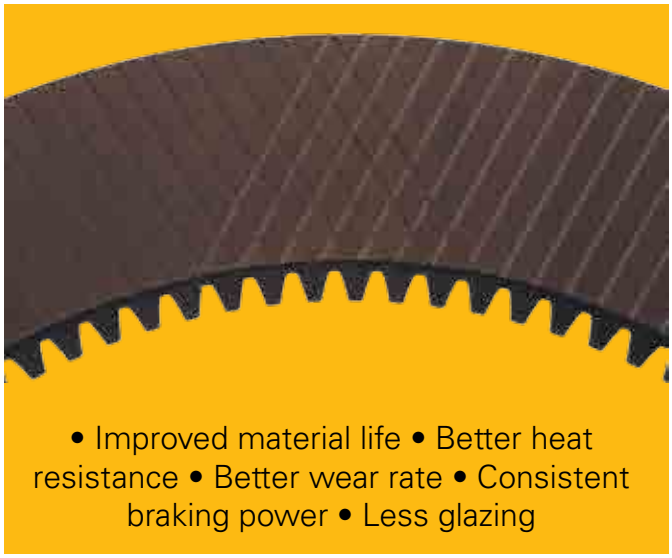
Real-world validation delivers better performance

- Caterpillar invests millions of dollars to design, test, and develop friction material for each machine application, a process that can take years. All friction material must undergo a stringent certification process to ensure it performs to Caterpillar specs.
- Cat elastomeric friction materials, for example, feature an exclusive material designed by Caterpillar that is moulded and bonded to a core for use in transmissions and load clutches in off-highway trucks and wheel loaders.
- Choosing Cat friction material is your assurance of safety and reliability – the result of real-world validation, quality assurance, and experience gained by millions of hours of operation. Other brands may not be subjected to such extensive validation.

Optimum drive train performance depends on the right friction material.

Cat Extended Life Friction Material

Purpose-designed for off-highway trucks and large wheel loaders



• Improved material life • Better heat resistance • Better wear rate • Consistent braking power • Less glazing

Caterpillar offers a friction material that provides extended life and increased heat resistance in wet brake systems. In certain applications, friction material may no longer be the limiting factor in the life of a final drive. This follows the development of Cat Extended Life Friction Material, which uses an innovative carbon paper for braking. A unique bonding process adds strength and helps prevent premature failures.

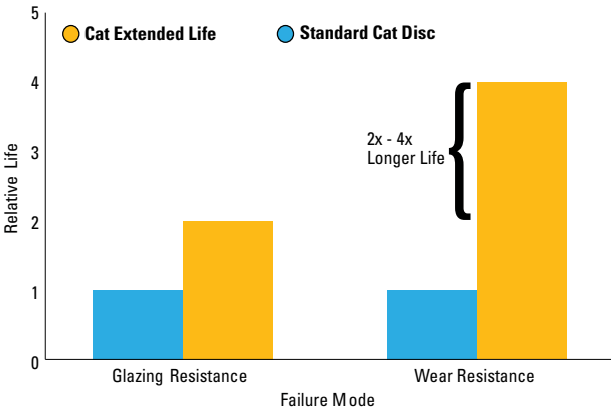
A significant step forward in braking technology, the relative wear life of Cat Extended Life Friction Material is up to four times greater than the Cat standard paper friction material and is twice as resistant to glazing. This resistance to glazing, which occurs during periods of high-temperature braking, is especially well-suited to heavy load applications like mining.

Brake Kits

Cat Extended Life Friction Material is available in brake kits for selected models. Give us a call for details on availability.

RELATIVE LIFE OF BRAKE FRICTION MATERIALS

Results May Vary Depending on Application & Severity



This graph demonstrates that the relative wear life of Cat Extended Life Friction Material is up to four times greater than the Cat standard paper material and is twice as resistant to glazing. This resistance to glazing, which occurs during periods of high-temperature braking, provides consistent braking power. It may also lessen audible brake noise.

FRICTION MATERIAL COST COMPARISON

TIME

Application	Final Drive Overhaul	Friction Disc Replacement Only	Final Drive Overhaul	Friction Disc Replacement Only	Final Drive Overhaul	Fewer Friction Discs Consumed*	Labour Hours Savings*
Light	● ●		●		● ●	33%	None
Normal	● ●	●	● ●	●	● ●	40%	64-102
Severe	● ●	● ●	● ●	● ●	● ●	57%	128-204

● Cat Extended Life ● Standard Cat Disc

* Percentages reflect fewer friction discs consumed final drive overhaul cycles using the Cat Extended Life Discs over Standard Discs. Labour hour savings based on brake replacements performed outside of normal overhaul cycle and may vary based on machine type (Models 777-789).

Brake life better matched to final drive life cycle: The chart above illustrates the potential reduction in the number of friction discs required and labour hours saving over the life of final drive overhaul cycles for off-highway trucks using Cat Extended Life Friction vs. Cat standard friction discs.

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Differential Maintenance

An Introduction

This guide discusses preventative maintenance, repair management options and highlights the components that wear and fail in the differential. By understanding these topics, machine owners can minimise owning and operating costs while maximising on-site productivity.

Understanding how differentials work

The differential plays a critical role within a machine's drive train by changing the direction of the power coming from the transmission 90 degrees to allow the axles to be driven. They also allow speed and torque differences between the left and right axles.

When a machine is turning, the differential lets the outside wheel move at a faster speed than the inside wheel, allowing for easier turning and less wear on tyres or tracks. The gears in the differential also provide speed reduction and torque increases.

In order to get the productivity and life you demand, it is important to maximise the life of these components by properly managing and maintaining them.

The key components of the differential are:

- The differential assembly, which turns the spider and pinion gears that mesh with the side gears, turning the axle shafts.
- Pinion gears, which transmit power from the spider to the side gears that are attached to the axle shafts.
- Side gears, which are splined to the axles and driven by the pinion gears.
- The spider, which serves as the mounting for the pinion gears, and rotates with the differential assembly.
- The bevel pinion gear, driven by the drive shaft.
- The bevel ring gear, which meshes with the bevel pinion gear, and is mounted to the differential assembly.

The key functions of a differential are:

- Transferring power coming from the transmission to the left and right axle shafts.
- Balancing the power according to the demand of each wheel.
- To transmit the power to the wheels while allowing them to rotate at different speeds.
- Gears in the differential further reduce speed and increase torque to drive the rear wheels.

DIFFERENTIAL CROSS SECTION

There are four types of differentials:

- Standard (as shown).
- Limited Slip.
- No Spin.
- Locking.

Preventative maintenance: Optimise equipment life

The key components in differential preventive maintenance include quality oils and filters, regular S•O•S Oil Analysis and contamination control.

Proper oil use

The three main functions of oil are to provide cleaning, cooling and lubrication. Modern Cat drive train systems feature new metals, elastomers and paper disc materials which may have advanced lubrication needs, requiring you to change oil regularly, properly, and use the right drive train oil to achieve top performance.

Use the right drive train oil

Cat differentials experience high gear and bearing loads and temperatures. In these conditions, it is important gears and bearings are protected.

It is essential that components be run in the correct oil. Always consult your Operations and Maintenance Manual for the specific oil needed.

Cat TDTO (Transmission Drive Train Oil) is specially formulated to increase the life and performance of your Cat drive train components.

This oil:
- Reduces transmission slippage.
- Controls brake chatter.
- Provides greater machine rimpull.
- Increases friction material life up to 45 percent.

Cat TDTO surpasses the TO-4 specification requirement and is specified as factory fill for all Caterpillar machine compartments where TO-4 is the primary recommendation.

Cat FDAO (Final Drive Axle Oil) was developed specifically to protect gears and bearings in bevel gears, differentials, final drives and axles that do not contain friction materials.

Cat FDAO is the preferred lubricant for Cat off-highway truck front wheels, differentials and final drives. It is compatible with Cat final drives and axles that previously specified TO-4 lubricants and do not contain friction material.

Cat FDAO has the following qualities:
- Compatible with Cat Transmission Drive Train Oil (TDTO).
- Excellent protection against rust and copper corrosion.
- Minimises foaming for increased lubrication.
- Low oxidation rate for improved oil life.
- Maintains desired viscosity and film strength.
- Provides reduced wear from debris particles suspended in the oil.

Cat Gear Oil offers maximum protection against the following damage: scoring of the gear teeth, pitting of the gear teeth, and pitting of the parts in roller bearings.

Cat Gear Oil provides:
- Excellent stability under high temperature conditions.
- Superior low temperature performance.
- Protection against rust and corrosion.

Some applications require additives for the extreme pressures that can occur at the edges of the components. For these applications, Cat Gear Oil provides the extra protection. Cat Gear Oil should not be used in compartments that specify TO-4 or TO-4M oil.

S•O•S Services

Importance of S•O•S Oil Analysis

Scheduled Oil Sampling is a crucial part of machine management. Oil sampling at scheduled intervals validates your maintenance procedures, tracks what is going on inside of the equipment and forecasts wear-related problems.

Our S•O•S Oil Analysis programme is well recognised for its ability to detect potential failures before they occur. Each S•O•S Services test is designed to reveal specific information about the condition of Cat products.

The four types of analysis are below:
- **Wear Metal** monitors and tracks metal wear particles, contaminants and oil additive package elements.
- **Oil condition** compares used oil to new oil to see if it is providing adequate lubrication and protection.
- **Oil Cleanliness** determines if abrasive contaminants are causing accelerated wear.
- **Oil Contamination** detects water, glycol, or fuel in oil.

Control Contamination: reduce overall operating costs

Dirt, sand, grit and even the finest dust can cause problems when they find their way into the differential. They cause parts to wear faster, making them more prone to premature failure.

There are four ways contamination can get into machine systems:
1. Contaminants can be built in during manufacturing and assembly operations.
2. Contaminants can enter during servicing and maintenance procedures.
3. Contaminants can enter with new fluid.
4. Contaminants can enter during operation through pitted shafts, broken breathers, worn seals and other trouble spots.

Fortunately there are steps you can take to prevent fluid contamination. An effective contamination control programme is made up of many small steps that help maintain fluid cleanliness and reduce opportunities for contaminants to get in machine systems. Caterpillar recommends a four-part contamination control programme consisting of:
1. Clean fluids.
2. Clean components.
3. Clean facilities.
4. Clean shop-repair processes.

By following these steps, you will be better prepared to control contamination, reduce overall operating costs and keep your Cat equipment performing at its best.

Filters

Control contamination inside your differential through the use of Cat fluid filters. By changing filters regularly and properly, and by selecting the right filters you maintain system cleanliness, reduce component wear and lower costs.

For further information on selecting the correct fluid filters, consult your machine's Operation and Maintenance Manual or contact your Barloworld Equipment customer service representative.

Repair management/ Repair indicators

Repair management is only one factor that influences your owning and operating costs. You should also address operating technique and application as well as preventative maintenance.

In the area of operating technique:
- Avoid high-speed direction changes.
- Avoid backing over obstructions.
- Avoid extreme braking.
- Operators should adequately warm-up the machine.
- Pay attention to warning lights.
- Do daily walk around inspections.

Application concerns might involve:
- Ambient temperature.
- Design of haul roads and repetitiveness of the work.

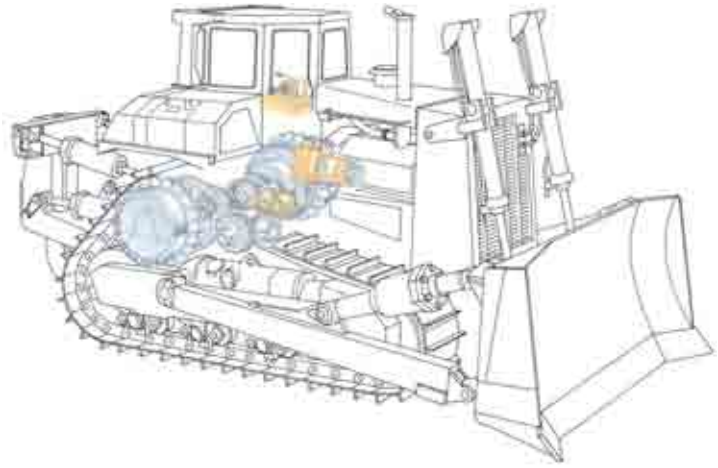
Repair Indicators

There are two types of indicators: planned and problem. Planned indicators are part of a good differential maintenance management programme that will give you before-failure repair options to lower your operating costs. Planned indicators are those that are performed or checked routinely such as S•O•S oil analysis, technical analysis, service meter hours, service history and Site Operations Maintenance Advisor (SOMA) software. (SOMA assesses customers' operating and maintenance practices and provides component life estimates.)

Problem indicators are usually found during inspection and include noises, leaks, overheating, and poor performance. Even with excellent maintenance, eventually repairs will be needed. However, problems can be caught early by performing daily inspections and responding quickly to repair indicators.

Keep in mind determining the cause is usually easier said than done. A visual exam may identify the type of damage, but it may not aid in recognising what is causing the problem. Remember, if you merely replace the failed component without finding and fixing the root cause, the replacement component will most likely endure the same wear and damage as the original.

For a list of planned and problem indicators for Cat differentials see the "Repair Indicators' section in this handbook.



Understanding differential steering

Differential steering uses three planetary gear sets and a hydraulic motor to change the speed of each track.

This system delivers uninterrupted power to both tracks during turns. Power from the transmission is delivered through the bevel gears to three planetary gear sets, then to the final drives and tracks. By adding power to one of the planetary gear sets, the motor adds (or redistributes) power to the steering differential, and by its direction of rotation, speeds up one track and slows down the other to make turns.

By rotating one direction, it makes a right turn, and by rotating the other direction, it makes a left turn. Thus the hydraulic motor determines the direction and degree of the turn.

The results are turns of any degree, from slight to sharp, without interruption in power. The operator turns, reverses direction and changes speed ranges using one hand on a single tiller. This Caterpillar patented steering system is available in the Cat D6R through D9R, and Challenger tractors.

The basic function of gears in the differential is to transfer power from the drive shaft to the axle shafts.

Causes of premature bearing failure

In order to maximise bearing life, it is important to eliminate the four primary causes of premature failure:

- Improper installation: bearings are not properly installed with the correct pre-load.
- Improper tolerances: width tolerances are incorrect for the application.
- Overload (fatigue), resulting from machine overloading or long hours of use.
- Contaminated lube oil, which causes accelerated surface pitting and premature failure.

Causes of premature gear failure

There are five primary causes of premature gear failure:

- **Pitting from surface:** normal end-of-life failure mode; however, consistent overloading accelerates this scenario.
- **Contaminated lube oil:** causes accelerated surface pitting and cracking.
- **Gear tooth bending fatigue:** the result of severe gear overloading.
- **Improper alignment:** creates unbalanced loading and contact on gears.
- **Improper lube oil,** which increases surface wear.

Bearings and gears: How they work

Bearings are used in the differentials to maintain position and alignment of gears and shafts, and to minimise friction, heat and wear. They also carry the weight of the vehicle and payload, subjecting them to very high loads and temperatures. Cat bearings have precision surfaces that are separated by a film of lube oil.

It is critical that the surface of the contact areas retains an adequate oil film thickness to prevent metal-to-metal contact with the mating part.

Loads are transferred through gears by gear teeth pushing against each other. Gears used in the differentials are put through a carburising and hardening process. This creates a durable outside surface enabling them to carry very high loads for thousands of hours. The gears are machined and precision ground to exact tolerances, making it crucial for the lubricating oil to be at its proper level to avoid metal-to-metal contact. The heat treatment, material and machining processes used on gears are based upon the specific application.

Caterpillar bearing design is application driven, which means Caterpillar offers the correct bearing for the application.

Key components/ Component durability

A look at the key components

Understanding how differentials work and wear is the key to maximising component life. Differential repair parts can be broken up into three groupings. They are:

Level I: Fastest wearing parts; not reusable.
- Anti-friction bearings.
- Seals and gaskets.
- Duo-cone seals.

Level II: Slower wearing parts; possibly reusable.
- Plates.
- Discs.
- Gears.

Level III: Longest life; designed not to be replaced.
- Housings and axles.

In order to correctly identify failure modes for differentials, it is necessary to understand how the component works, the causes of its premature wear or failure, and the maintenance steps that can be taken to minimise the causes of wear and failure.

Key steps to improving component durability

Clean lube oil
By far, the most common and preventable cause of component failure is due to contaminated lube oil. To ensure components run in clean lube oil, it should be built clean, installed clean and operated clean.

Correct lube oil
It is essential to the component's life to be run in high-quality lube oil. Using the correct lube oil will improve component wear life up to 40% in some applications.

Proper installation and assembly
Components are built with specific tolerances and preloads. Proper installation and assembly practices are absolutely essential to component life.

Avoid overload and fatigue
Two factors that dramatically accelerate subsurface fatigue and component life are excessive loads and rolling resistance.

Replace parts before failure
Differential piece parts do not have an infinite life. After being run for thousands of hours at high loads and temperatures, the material will eventually fatigue. Thorough inspection of the components results in early detection of defect and deterioration before parts fail completely and damage other vital components.

Repair options/Scheduling and record-keeping

Selecting the right repair option

Selecting the right repair option is a way to lower owning and operating costs.

Before-failure repairs

Repairing before failure gets your machine back to work sooner and costs two to three times less than after-failure repairs.

Our before failure repair options:
- Help prevent major failures and failure of related parts.
- Maximise parts reusability designed into many differential parts.
- Allow you to schedule downtime and plan costs.
- Maximise equipment life and productivity.

Differential repair options:
- **Reseal:** required when oil leaks are discovered during inspections.
- **Re-bearing and reseal:** signalled by excessive leaks, elevated S.O.S results or target hours.
- **Before-failure overhaul:** involves rebuilding the entire differential.

After-failure repairs
Repairing before failure is the best way to reduce your downtime and costs. However, if your differential system does fail, we are in the best position to help you control costs and save time. Part replacement costs are kept to a minimum, using Cat Parts Reusability Guidelines and replacing only damaged components.

Possible options include using Exchange or Cat Reman components. Cat Reman components are available from inventory, offer same-as-new performance, and carry the same warranty as new components at a lower cost.

After-failure overhaul is recommended when large pieces of metal are discovered during magnetic plug inspections, when failure occurs or when broken parts are discovered during before-failure procedures. It includes removal and replacement of the entire differential and axle group.

Scheduling and record keeping

Good scheduling means maintenance, inspections and planned repairs are done on time to prevent differential failures caused by overlooked maintenance. You can also view S•O•S Oil Analysis results on-line.

Record keeping

By developing an accurate machine record-keeping system, you can identify high-cost or problem areas, track work flow, control costs, and increase machine resale value. An accurate record keeping system documents drive train history by detailing component life and cost information. We can help you set up manual record keeping and work order systems, or we can help you install computer software programs to perform scheduling, checklists and other record keeping functions.

Final Drive Maintenance

A Management Guide

Final drives play a crucial role within a machine's drive train by transferring power to the tyres or tracks while providing speed reduction and torque increase.

Final drives are closed components and thus hidden from view and for this reason it is easy to overlook routine maintenance requirements. In response, effective system management will lead to fewer failures, less downtime and better machine resale value.

This guide discusses preventive maintenance, repair management options, and highlights the main components that wear and fail in final drive systems.

By understanding these topics, you could minimise your owning and operating costs while maximising your productivity.

Overview

Cat final drive components must endure incredible torque, high-impact loads, and frequent direction and gear changes. In fact, the final drive is where the highest torque increase occurs.

Caterpillar designs and manufactures its final drive components with these demands in mind, using testing processes that simulate real-world applications. In order to get the productivity and efficiency you demand, it is important to maximise the life of these components by properly managing and maintaining them.

To withstand the forces of high torque and impact loads, Cat final drive components are:

- Designed to work and wear as a system for smooth, reliable operation.
- Manufactured and tested for precise fit and consistent quality.
- Heat-treated for durability and long life in their specific application.

Controlled manufacturing processes, and use of high-quality materials, enable Cat final drives to be remanufactured for a second life. Cat Reman final drives offer same-as-new performance, long life and quick turnaround, all at a fraction-of-new prices. Currently, Reman final drives are available for off-highway trucks, large wheel loaders, large wheel dozers, large compactors and specific track-type tractors.

A good drive train management programme is a team effort – your regular maintenance programme supplemented by Barloworld Equipment's maintenance support, products and services. Together, we can maximise drive train and component performance, identify and react to any potential problems before they become failures, and lower your owning and operating costs.

Preventative maintenance

The key components in final drive preventive maintenance include quality oils and filters, regular S.O.S Oil Analysis and contamination control.

Preventive maintenance:

- Allows you to schedule downtime and plan for maintenance and repair costs.
- Helps prevent major failures, including failure of related parts.
- Saves you money because you can often repair before failure.
- Reduces total downtime.
- Maximises parts reusability.
- Optimises equipment life to keep your machine productive and on the job.
- Increases machine resale value.

Proper oil use

The three main functions of oil are to provide cleaning, cooling and lubrication. Modern Cat drive train systems feature new metals, elastomers and paper disc materials which may have advanced lubrication needs, requiring you to change oil regularly, properly, and use the right drive train oil to achieve top performance.

Use the right drive train oil

Cat final drives, axles and differentials experience high gear and bearing loads and temperatures. In these conditions, it is important that gears and bearings are protected. Final Drive and Axle Oil (FDAO) is the preferred lubricant for Cat final drives and axles not containing friction materials. FDAO is used where T0-4 was previously specified, but should not be used in compartments that contain friction material because this oil does not generate a sufficient friction coefficient to satisfy the requirements of most brakes and clutches.

Help your final drives reach a new level of performance with Cat FDAO:

- Compatible with Cat Transmission Drive Train Oil (TDTO).
- Excellent protection against rust and copper corrosion.
- Controls foaming for increased lubrication.
- Low oxidation rate for improved oil life.
- Maintains desired viscosity and film strength.
- Provides reduced wear from debris particles suspended in the oil.

Cat FDAO is a factory fill for:

- Off-highway truck front wheels, differentials and final drives.

Repairing before failure gets your machine back to work sooner and costs two to three times less than after-failure repairs.

- D6R-D11 dozers, pipelayers (572, 583, 589) and track skidder final drives (steel-tracked machines with elevated final drives, except the D5M and 561M).

Change oil properly

It is critical to change oil properly and at the correct intervals. Actual oil life is determined by many factors such as operating conditions, applications and contamination control. To reduce contamination, it is important to:

- Drain oil as quickly as possible, and when it is agitated and warm.
- Use a filtered transfer cart when filling with or adding new oil.
- Remove and install filters carefully.
- Keep filters in their package until ready for use.
- Cut open and inspect used filters before installing new ones.

It is essential that components be run in the correct oil. Always consult your Operations and Maintenance Manual for the specific oil needed.

The Importance of S·O·S Oil Analysis

S·O·S oil analysis is a crucial part of machine management. Oil sampling at scheduled intervals validates your maintenance procedures, tracks what is going on inside of the equipment and forecasts wear-related problems.

Our S·O·S oil analysis programme is well recognised for its ability to detect potential failures before they occur. Each S·O·S Services test is designed to reveal specific information about the condition of every Cat product.

The four type of analysis are listed below:

- **Wear Metal:** monitors and tracks metal wear particles, contaminants and oil additive package elements.
- **Oil Condition:** compares used oil to new oil to see if it is providing adequate lubrication and protection.
- **Oil Cleanliness:** determines if abrasive contaminants are causing accelerated wear.
- **Oil Contamination:** detects water, glycol or fuel in oil.

Advantages of using S·O·S Services:
Surveys have shown that there are many benefits to using our S·O·S oil analysis programme:

- Experts can provide analysis and interpretation of trends and can forecast any excessive wear concerns.
- Test results are available within 24 hours after receipt of the sample.
- Easy-to-understand test reports call for specific action and/or makes carefully outlined recommendations.
- Saves time and money by identifying trouble spots before they become major failures.

S·O·S Services help you avoid complete failures. Often an adjustment or replacement of a single part, based on S·O·S Services findings, can prevent a small problem from growing into a major repair. S·O·S Oil Analysis is different from other

The final drive is where the highest torque increase occurs.

oil analysis programmes because it focuses on component condition, not just oil condition.

Since only Caterpillar knows the exact design of your Cat drive train system, we can help you analyse S·O·S reports, determine what additional tests need to be performed, and recommend the proper corrective action.

Particle count

Particle count is another way of assuring oil cleanliness. When used in conjunction with fluid analysis, particle counting can be a valuable tool in reducing failures in final drive systems. The particle count instrument counts the number of particles in several different size ranges, from as small as two microns to over 100 microns.

It measures both metallic and non-metallic particles and provides an early warning of abnormal component wear and contaminant ingestion.

Contamination Control

Dirt, sand, grit and even the finest dust can cause problems when they find their way into the final drive system. They cause parts to wear faster, making them more prone to premature failure.

There are four ways contamination can get into machine systems:

1. Contaminants can be built in during manufacturing and assembly operations.
2 Contaminants can enter during servicing and maintenance procedures.
3 Contaminants can enter with new fluid.
4 Contaminants can enter during operation through pitted shafts, broken breathers, worn seals and other trouble spots.

Fortunately there are steps you can take to prevent fluid contamination. An effective contamination control programme is made up of many small steps that help maintain fluid cleanliness and reduce opportunities for contaminants to get in machine systems. Caterpillar recommends a four-part contamination control programme consisting of:

1 Clean fluids.
2 Clean components.
3 Clean facilities.
4 Clean shop-repair processes.

By following these steps, you will be better prepared to control contamination, reduce overall operating costs and keep your Cat equipment performing at its best.

Filters

Control contamination inside your final drive system through the use of Cat fluid filters. By changing filters regularly and properly, and by selecting the right filters, you maintain system cleanliness, reduce component wear and lower costs.

Change filters regularly
In order to keep your drive train system running clean and at peak performance, it is important to change the filters regularly.

This reduces the chance of contamination, which causes component wear and system failure. We recommend changing fluid filters at least every 500 hours. This change interval will vary with application, environment and type of filter being used.

Change filters properly
It is important to remove old filters carefully to ensure the contaminants they hold do not re-enter the drive train system. It is also critical to keep new filters in their packaging until you are ready to install them. This protects the filter and reduces the chances of contaminants entering the system, especially on the clean side of the filter media.

Select the right fluid filters
The use of fluid filters in final drive systems varies by machine type. Filters can be found on the 797 and 793 off-highway trucks and machines using a common reservoir system such as backhoe loaders. For further information on selecting the correct fluid filters, consult your machine's Operation and Maintenance Manual or contact your Barloworld Equipment customer service representative.

Repair management / Repair indicators

Repair management helps you select before-failure and after failure repair options that allow you to control repair costs and minimise downtime. Performing daily inspections is an important way to identify small problems before they become major failures.

Inspection
Daily walk-around inspections should include a complete visual and operational check of your machine. You should be aware of any strange noises, leaks, slippage, overheating or brake chatter. When used alongside Preventive Maintenance and S·O·S Services, a good inspection programme maximises equipment value by minimising repair costs and unscheduled downtime.

A preventive inspection plan can:
- Detect potential problems and impending failures before any additional damage occurs.
- Help schedule maintenance and any needed repairs to plan for downtime and control costs.

Site Operations and Maintenance Advisor (SOMA)
Site Operations and Maintenance Advisor (SOMA) can significantly reduce your owning and operating costs. SOMA is a software tool that can help you identify repair before failure opportunity windows. It is able to provide component life estimates by assessing the machine's operating and maintenance practices. Contact your Barloworld Equipment customer service representative to arrange a comprehensive SOMA study.

Repair indicators

There are two types of indicators: planned and problem. Planned indicators are those that are performed or checked routinely, such as S·O·S Oil Analysis, Technical Analysis, service meter hours, service history and SOMA software. Problem indicators are usually found during inspections and include noises, leaks, overheating and poor performance.

Even with excellent maintenance, eventually final drive repairs will be needed. However, problems can be caught early by performing daily inspections and responding quickly to repair indicators.

PROBLEM INDICATORS	POSSIBLE CAUSES
Brake Slippage	Worn plates and discs
	Wrong oil used
	Linkage out of adjustment
	Incorrect pressure settings
	Low fluid level
Unusual Noises	Worn gears/bearings
	Dirt entry
	Low fluid level
Overheating	Wrong oil used
	Low fluid level
	Worn or damaged seals
Debris on Magnetic Plug	Dirt entry
	Wrong oil used
	Extended oil change period
	Disc disintegration
	Worn gears or bearings
Vibration	Gear failure
	Sprocket failure
	Bearing failure
Leaks	Worn, hard or cracked seals

Repair Options

Selecting the right repair option is a way to lower owning and operating costs.

Before-Failure Repairs

Repairing before failure gets your machine back to work sooner and costs two to three times less than after-failure repairs. Our before failure repair options:

- Help prevent major failures and failure of related parts.
- Maximise parts reusability designed into many final drive parts.
- Allow you to schedule downtime and plan costs.
- Maximise equipment life and productivity.

Final drive repair options:
- **Reseal:** required when oil leaks are discovered during inspections.
- **Re-bearing and reseal:** signalled by excessive leaks, elevated S·O·S results or target hours.
- **Upper pinion re-bearing and reseal (low-sprocket TTT):** recommended when an S·O·S report shows elevated results of iron and lead.
- **Steering clutch and brake reconditioning:** addresses worn friction materials to ensure proper steering and brake performance.
- **Before-failure overhaul:** involves rebuilding the entire final drive.

After-failure repairs

Repairing before failure is the best way to reduce your downtime and costs. However, if your final drive system does fail, we are in the best position to help you control costs and save time. Part replacement costs are kept to a minimum, using Cat Parts Reusability Guidelines and replacing only damaged components. Possible options include using Exchange or Cat Reman components. Cat Reman components are available from inventory, offer same-as-new performance, and carry the same warranty as new components at a lower cost.

After-failure overhaul is recommended when large pieces of metal are discovered during magnetic plug inspections, when failure occurs or when broken parts are discovered during before-failure procedures. It includes removal and replacement of the entire axle group and a complete rebuild of final drives, the differential and brakes.

A look at the key components

Understanding how final drives work and wear is the key to maximising component life. Final drive repair parts can be broken up into three groupings. They are:

Level I: fastest wearing parts, not reusable.
- Anti-friction bearings.
- Seals and gaskets.
- Duo-cone seals.

Level II: slower wearing parts, possibly reusable.
- Plates.
- Discs.
- Gears.
- Shafts.

Level III: longest life, designed not to be replaced.
- Housings, hubs and carriers.

In order to correctly identify failure modes for final drives, it is necessary to understand how the component works, the causes of its premature wear or failure, and the maintenance steps that can be taken to minimise the causes of wear and failure.

Bearings

How they work

Bearings are used in the drive train system to maintain position and alignment of gears and shafts, and to minimise friction, heat and wear. They also carry the weight of the vehicle and payload, subjecting them to very high loads and temperatures. Cat bearings have precision surfaces that are separated by a film of lube oil. It is critical that the surface of the contact areas retains an adequate oil film thickness to prevent metal-to-metal contact with the mating part.

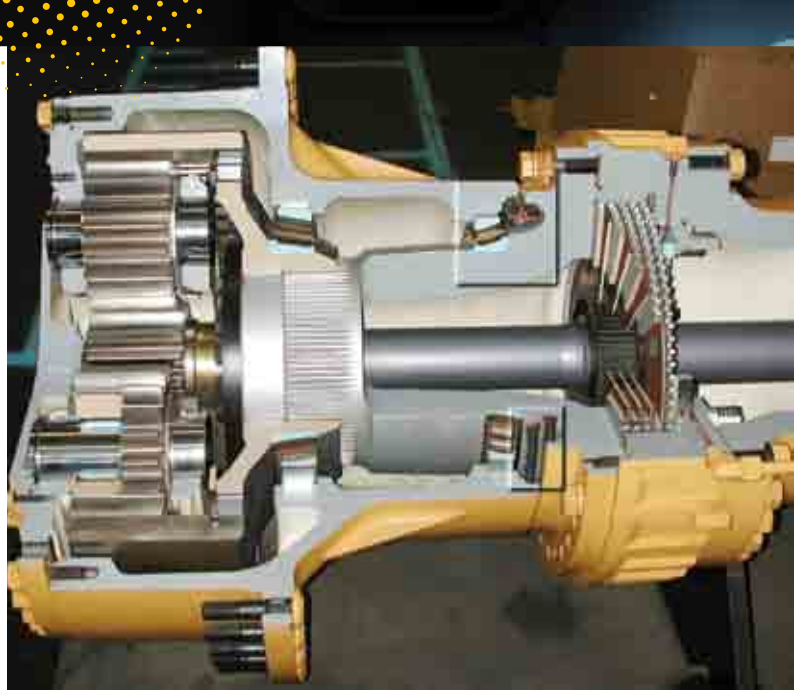
Caterpillar bearing design is application driven, which means we offer the correct bearing for the application.

Below are two examples of application-specific bearings:
- Textured anti-friction bearings for use in slow-speed, high-load applications.
- Debris-resistant anti-friction bearings in high-load, tight tolerance applications provide twice the life of standard bearings.

Causes of premature failure

In order to maximise bearing life, it is important to eliminate the four primary causes of premature failure:

- **Improper installation:** bearings are not properly installed with the correct pre-load.
- **Improper tolerances:** width tolerances are incorrect for the application.
- **Overload (fatigue):** resulting from machine overloading or long hours of use.
- **Contaminated lube oil:** causes accelerated surface pitting and premature failure.



Gears

How they work

The basic function of gears in the final drive system is to provide speed reduction and increase torque. Loads are transferred through gears by gear teeth pushing against each other. Gears used in the final drives are put through a carburising and hardening process. This creates a durable outside surface enabling them to carry very high loads for thousands of hours. The gears are machined and precision ground to exact tolerances, making it crucial for the lubricating oil to be at its proper level to avoid metal-to-metal contact. The heat treatment, material and machining processes used on gears are based upon the specific application.

Causes of premature gear failure

There are five primary causes of premature gear failure:

- **Pitting from surface fatigue:** normal end-of-life failure mode; however, consistent overloading accelerates this factor.
- **Contaminated lube oil:** causes accelerated surface pitting and cracking.
- **Gear tooth bending fatigue:** the result of severe gear overloading.
- **Improper alignment:** creates unbalanced loading and contact on gears.
- **Improper lube oil:** increases surface wear.

Duo-cone™ seals

Duo-Cone seals are metal-faced seals used to provide oil sealing in extreme or abrasive rotating applications involving high speed and load. They use two large flexible toric rings to apply force to the opposing metal sealing rings to hold them together.

These seals carry the important function of keeping contaminants, dirt and debris out of the drive train, and oil in.

Causes of premature Duo-Cone seal wear

There are four primary causes of premature seal wear:

- **Improper installation:** caused by uneven or excess seal face load or handling damage.
- **Polishing housing surfaces:** allows toric rings to slide rather than roll, resulting in inadequate loading of the metal sealing faces.
- **Contaminated lube oil:** abrasive particles accelerate wear of metal seal rings.
- **Toric ring compression set from overheating:** overheating lube oil causes the toric ring to lose its ability to apply the correct load to the seal faces.

Clean lube oil

By far, the most common and preventable cause of component failure is due to contaminated lube oil. To ensure components run in clean lube oil, it should be built clean, installed clean and operated clean.

Correct lube oil

It is essential to the component's life to be run in high-quality lube oil, such as Cat FDAO. Using the correct lube oil will improve component wear life up to 40% in some applications.

Proper installation and assembly

Components are built with specific tolerances and preloads. Proper installation and assembly practices are absolutely essential to component life.

Avoid overload and fatigue

Two factors that dramatically accelerate subsurface fatigue and component life are excessive loads and rolling resistance.

Replace parts before failure

Final drive piece parts do not have an infinite life. After being run for thousands of hours at high loads and temperatures, the material will eventually fatigue. Thoroughly inspecting the components results in detecting defects and deterioration before they fail completely and damage other vital components.

Scheduling and record keeping

Scheduling

Good scheduling means maintenance, inspections and planned repairs are done on time to prevent drive train failures caused by overlooked maintenance. You can also view S·O·S Oil Analysis results online.

Record keeping

By developing an accurate machine record keeping system, you can identify high-cost or problem areas, track work flow, control costs and increase machine resale value. An accurate record keeping system documents drive train history by detailing component life and cost information. We can help you set up manual record keeping and work order systems, or we can help you install computer software programs to perform scheduling, checklists and other record keeping functions.

Maximise the life of your final drives

For any machine to be safe, reliable and productive, regular preventive maintenance is vital. It is the most cost-effective way to keep your final drives operating at peak performance. If you take care of your final drives, then gears and shafts can last through multiple rebuilds and the overall final drive life increases. Take a proactive approach by planning for scheduled downtime, maintenance and repair costs. When you plan, you save money and time – and who couldn't use more of each?

A HIGHER YIELD

Medium Size Excavators. Our current range offers excellent controllability and reliability, impressive lift capacity, better fuel efficiency, simplified service and a more comfortable operator station to increase your productivity and lower your operating costs.

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Barloworld Equipment CAT

Transmission Maintenance

A Management Guide

The transmission is a critical part of a machine's power train. Its function is to take the output from the engine and manipulate it to control speed, direction and torque. Following a planned maintenance programme and Caterpillar's recommended maintenance guidelines can help ensure longer life for your transmission and reduce machine downtime.

Because of the wide variety of work they do, Caterpillar products use several transmission types, including planetary powershift, countershaft powershift, direct drive and hydrostatic. Each is designed to convert engine power into the exact combination of speed, direction and torque required for the particular application.

Transmissions do this by various means such as hydraulic clutches or a hydrostatic/hydraulic drive. Transmissions rely on the engagement of gear groups to provide the transfer of power to your machine components. Caterpillar designs all parts, including these gear groups, to fall under three levels of wear.

By understanding that different components are intended to wear faster than others, you can inspect for signs of wear and keep your transmission running smoother for longer. For example, gears and shafts, if properly maintained, are designed to last through multiple transmission rebuilds. But components such as friction material, seals, gaskets and bearings are faster wearing.

To increase productivity and prevent downtime, it's vital to make sure that all drive train components are constantly monitored. Look at their condition to ensure contamination isn't entering their systems and to check that correct operating techniques are being used.

This section focuses on how to identify problem indicators and how to maximise the performance and life of your transmission.

Importance of S·O·S

Scheduled Oil Sampling is a crucial part of machine management. Oil sampling at scheduled intervals validates your maintenance procedures, tracks what is going on inside the equipment and forecasts wear-related problems.

The Caterpillar S·O·S Oil Analysis programme is well recognised for its ability to detect potential failures before they occur. Each S·O·S Services test is designed to reveal specific information about the condition of Cat products.

The following wear table outlines transmission failures and their common indicators, identified by using the S·O·S Service.

S·O·S TRANSMISSION FLUID ANALYSIS INDICATORS	
Friction Material	**Bearing or Bushing Failure**
✓ Si, Cu, Pb (friction materials)	✓ Cu, Pb and/or Sn (bronze bushing or thrust washer)
✓ Fe (separator plates)	✓ Cr (rolling element bearing)
✓ ISO Code (larger particles)	✓ Fe (rolling element bearing, shaft, iron housing)
✓ Oxidations (caused by overheating the oil)	✓ ISO Code (larger particles)
✓ Incorrect fluid (difficult to identify)	
Sticking Control Valves	**Dirt Entry**
✓ ISO Code (larger particles)	✓ Si and Al (dirt)
✓ Fe (debris)	✓ Fe (separator plates, gears)
✓ Oxidation (caused by overheating the oil)	✓ Cu, Pb, Sn (bronze bushings or thrust washers)

What do these S·O·S indicators mean?

If excessive amounts of silicate (Si) and aluminium (Al) are found in the transmission fluid, it means the oil is contaminated with dirt. The S·O·S experts might recommend you change your oil right away and to change it more frequently in the future. High levels of copper (Cu), iron (Fe) and lead (Pb) would indicate abnormal wear of the bronze friction discs and steel separator plates. Recommendations would include stopping the machine and inspecting the transmission. Also, you would be advised to cut open and inspect the oil filter for large particles.

What tests are done by S·O·S Services?

The S·O·S Oil Analysis consists of four standard analysis tests:

- **Component Wear Rate:** determination of which components are wearing and at what rate.
- **Oil Contamination:** What contaminates are showing up in the oil?
- **Oil Condition:** Is the correct transmission oil being used? Has the oil been exposed to excessive heat?
- **Oil Identification:** Is there coolant or water leaking into the oil? Is the right oil being used?

Consult your Barloworld Equipment customer service representative for further information about the Barloworld Equipment Condition Monitoring Centre in Boksburg, which incorporates the S·O·S laboratory.

10:1 is a common payback ratio when comparing the amount saved on repair costs to the amount invested in S·O·S Services.

Preventative maintenance

Regular preventive maintenance is the most cost-effective way to keep your transmission operating at peak performance. Preventive maintenance focuses on transmission and drive train oils, filters, S·O·S and contamination control.

Preventive maintenance:
- Allows you to schedule downtime and plan for maintenance and repair costs.
- Helps prevent major failures, including failures of related parts.
- Saves you money because you can often repair before failure.
- Maximises parts reusability.
- Optimises equipment life to keep your machine on the job.
- Increases machine resale value.

Proper oil use

Oil helps to perform three main functions: cleaning, cooling and lubricating the transmission. Today's transmissions feature new metals, elastomers and paper disc materials that require advanced lubrication. You must use the right oil and change it regularly and properly to achieve top performance.

Use the right drive train oil

Caterpillar Transmission/Drive Train Oil (TDTO) is specially formulated to increase the life and performance of your Cat drive train components. This oil reduces transmission slippage, controls brake chatter, provides greater machine rimpull and increases friction material life up to 45 percent. Cat TDTO surpasses the TO-4 specification requirements and is specified as factory fill for all Caterpillar machine compartments where TO-4 oils are the primary recommendation.

Change oil properly

Changing oil properly and at correct intervals is critical to realising maximum component life. Actual oil life is determined by many factors such as operating conditions and applications or contamination control. You can reduce contamination by:
- Washing the transmission tank and drain before removing the cap.
- Draining oil as quickly as possible and doing so when it is agitated and warm.
- Using a filtered transfer cart to add new oil.
- Installing and removing filters carefully.
- Keeping filters in their packaging until ready for use.
- Cutting open and inspecting used filters before installing new ones.

Filters

Caterpillar filters are specifically designed around key factors such as sediment capacity, collapsibility, burst strength and pressure fatigue. By properly and regularly changing filters and by selecting the right filters, you maintain drive train system cleanliness, reduce component wear and lower costs.

In addition to the standard Cat filters, Caterpillar also provides High Efficiency Filters. They use a synthetic media to remove a higher proportion of both large and small particles. High Efficiency Filters should be used for 250 service hours, after any maintenance, rebuild or debris invasion, or when suggested by particle count data from S·O·S Services. It's then recommended to switch back to standard filters.

When replacing an old transmission filter it's extremely important to cut open the filter and inspect for signs of component wear or clogging. Pieces of metal may be found in or around the magnetic screen and can indicate a certain component is failing.

Possible sources of metal pieces:
- **Aluminium:** torque converter.
- **Bronze coloured:** transmission clutches.
- **Gray iron:** transmission housing or pistons.
- **Brass:** rings in rotating clutches.
- **Shiny metals:** gear teeth.
- **Shiny flaky material:** bearings.

Breathers

Breathers are extremely important in transmission preventive maintenance. If breathers become plugged and temperatures dip down during the evening, the cab becomes a vacuum because the cool air inside the cab shrinks.

As the air inside the cab shrinks it draws in air, dirt and other contaminants through the gaskets and seals. If this occurs regularly, the gaskets and seals may sustain enough damage to allow water and other contaminants into the cab. Dirt and water are especially harmful to the electronics.

Solenoids in your electronics control when and how quickly your clutches engage. When the solenoids become contaminated they become sluggish and your clutches may engage too quickly or they may slide. To get the most use out of this filter, cover the breather before washing your equipment and check your breather for clogging when inspecting other machine components.

Contamination Control

Customers demand more power, faster cycle times and easier operation. To meet these needs, Caterpillar is responding with higher system pressure and more sophisticated, productive machines.

Controlling contamination is more critical than ever because these high-tech machines require tighter clearances and fluid systems that are more sensitive to contamination. Contamination leads to reduced efficiency, increased cycle times, shortened component and fluid life, and catastrophic failure causing costly downtime and repairs.

Causes of Contamination

Contamination can be introduced at the refinery, during machine operation or during maintenance.

Contaminants include:
- Dirt.
- Sealing material.
- Metals.
- Grease.
- Products from oil oxidation.
- Weld spatter.
- Heat.

- Air.
- Paint flakes.
- Water.
- Rag fibres.

Effects of contamination in transmissions

Contaminants in transmissions cause:
- Shifting problems from plugged control valves.
- Premature clutch wear from spinning.
- Leaks or premature wear.
- Premature bearing wear or bearing failure.
- Premature gear wear.

Preventing contamination

Prevent contamination by practicing good housekeeping in the shop, using proper oil storage and transfer methods, keeping parts packaged during handling and storage, cleaning components thoroughly during repair and assembly and performing particle count monitoring.

Good housekeeping practices:
- Sweep floors daily.
- Clean up spills immediately.
- Keep workbenches uncluttered and free of debris.
- Limit use of floor storage.

Proper oil storage and transfer methods:
- Filter new oil.
- Store oil drums on their sides.
- Use drum covers.
- Use the "kidney loop" system.
- Use high efficiency filters for extra filtration.

Repair and assembly:
- Place covers over open compartments.
- Ensure that the root cause of failure has been identified and repaired.
- Use standard parts kits for all component installations.

Particle count monitoring:
- Strive for oil cleanliness.
- Test oil in new machines after field assembly or after adding new attachments.
- Test oil before and after service repairs.

Thorough inspection

A good inspection programme combines your daily inspections with our periodic in-depth analysis. By combining both, you can:
- Locate potential problems before they become major repairs.
- Schedule transmission maintenance and service.
- Plan and control your operating costs and downtime.

Your daily visual inspection routine should include a complete visual and operational check of your transmission. The following chart summarises planned and problem indicators that are associated with the transmission.

CAT TRANSMISSION REPAIR INDICATORS

Planned Indicators	Description
S·O·S Services	S.O.S Services provide the best insight into internal transmission wear and potential failure.
Service Meter Hours	Our dealers use service meter hours as a repair indicator.
Operator Discussion	Talking with your machine operator can reveal many potential transmission problems.

Problem Indicators	Possible Causes	Options
Hesitation/ Slippage	Worn plates and disks Linkage out of adjustment Low fluid level Linkage not free Incorrect pressure settings Wrong oil used	Technical Analysis Inspection Repair Determination Inspection S.O.S Services Customer/Dealer Discussion
Unusual Noises	Worn gears/bearings Dirt entry Aeration/cavitation Low fluid levels	Technical Analysis Inspection Repair Determination Inspection S.O.S Services Customer/Dealer Discussion
Vibration	Bent shaft drive Gear failure Bearing failure	Technical Analysis Inspection Repair Determination Inspection S.O.S Services Customer/Dealer Discussion
Overheating	Wrong oil used Plugged radiator Worn pump/pressure relief valve Worn or damaged seals Low fluid level Worn or dirty control valve	Technical Analysis Inspection Repair Determination Inspection S.O.S Services Customer/Dealer Discussion
Debris in Filter/ on Magnetic Screen	Dirt entry Wrong oil used Extended oil change period Worn gears/bearings Disc disintegration	S.O.S Services Customer/Dealer Discussion
Leaks	Worn, hard or cracked seals	Repair Determination Inspection Customer/Dealer Discussion
Bent or Damaged Lines	External damage	Technical Analysis Inspection Repair Determination Inspection Customer/Dealer Discussion

Transmission maintenance DO's and DON'Ts

Do's

1. Make sure the fluid meets ISO standards before pouring it in your machine.
2 Use the correct transmission oil: Caterpillar recommended fluids found in the Operation and Maintenance Manual.
3. Use Cat filters.
4. Cut open old filters to inspect for indications of a problem.
5. Keep accurate records.
6. Follow the proper machine service hour guidelines.

DON'Ts

1. Do not open your transmission system in a dirty environment.
2. Always keep in mind proper Contamination Control guidelines.
3. Do not abuse your machine (application, operation, etc.).
4. Do not pre-fill filters (fuel or oil).

Training, scheduling and record keeping

Training

Operating technique has a direct impact on drive train wear and maximising machine life. Proper training is important to identify good and bad operator techniques.

Avoid:

- High-speed direction changes.
- Backing over stumps or off a lowboy.
- Operating with a frozen undercarriage.
- Extreme braking.

Implement:

- Adequate warm-up.
- Periodic and proper shifting.
- Attention to warning signs.
- Daily walk-around inspections.

Drive train life is also impacted by the applications in which a machine operates throughout the year. Key factors include the operating environment and the layout of the jobsite.

Operating environment:

- Seasonal temperatures often affect fluid choices, change intervals, inspection and operating practices.
- Operating in water increases the chance of water entering and contaminating the transmission fluid system and may cause a loss of braking ability.

Job site layout:

- Well-paved and maintained haul roads reduce the jarring impact on the drive train and other machine systems.
- Repetitive and high-speed load and carry applications can cause brake overheating.

Scheduling

We can help you develop an effective scheduling system by providing you with time and cost record booklets or software programs.

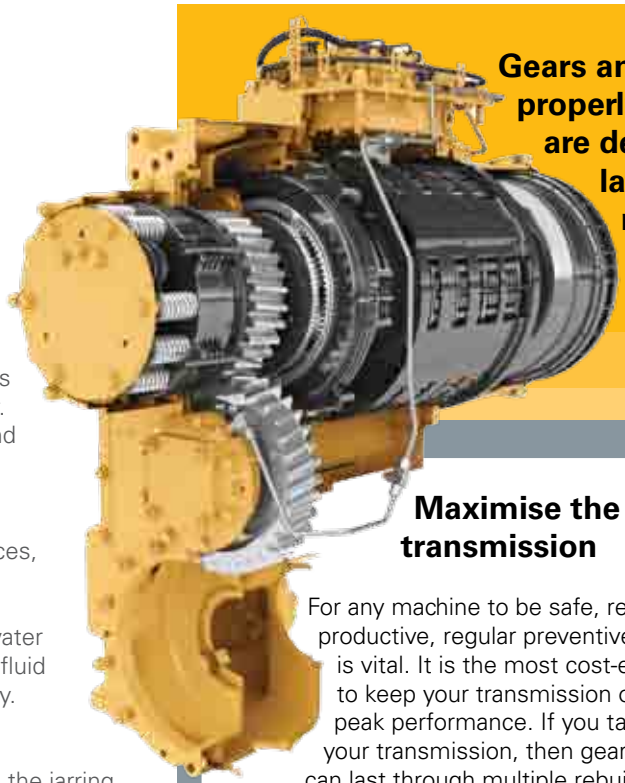
Use Maintenance Control System (MCS) software to schedule your maintenance and record machine operating costs and time usage. This software allows you to download S·O·S reports from Trend Analysis Module (TAM) software. You can also bring customised checklists from the Planned Maintenance Planner (PMP) software into MCS. Print them when each level of maintenance is due.

Good scheduling means maintenance, inspections and planned repairs are done on time so you can prevent any transmission failures caused by overlooked maintenance.

Record keeping

An accurate record keeping system documents drive train history by detailing component life and cost information. We can help you set up manual record keeping and work order systems, or we can help you install computer software programs such as the Preventive Maintenance Planner (PMP) or the Maintenance Control System (MCS). These programs perform scheduling, checklists and other record-keeping functions.

By developing an accurate machine record keeping system, you can identify high-cost or problem areas, track work flow, control costs and increase machine resale value.



Gears and shafts, if properly maintained, are designed to last through multiple transmission rebuilds.

Maximise the life of your transmission

For any machine to be safe, reliable and productive, regular preventive maintenance is vital. It is the most cost-effective way to keep your transmission operating at peak performance. If you take care of your transmission, then gears and shafts can last through multiple rebuilds and the overall transmission life increases. Take a proactive approach by planning for scheduled downtime, maintenance and repair costs. When you plan, you save money and time, and who couldn't use more of each?

Frequently asked questions

What are some of the subtle signs that you may have transmission problems?

Overheating, slippage or jerky shifting can signify a problem with a transmission component. If this occurs, carry out a thorough machine inspection and take an S·O·S sample.

What are some of the primary causes of transmission failure and/or reduced power output or performance?

Low oil pressure can cause clutch slippage. Check your transmission filter and oil levels in the transmission. They may need replacing. Incorrect pressure may cause transmission failure or reduced power output or performance. Transmissions are designed to run at around 200 lbs of pressure. Check all pressures to ensure correct levels. Contamination from other failing parts can cause plugged filters. Check all parts for contamination.

Are oil additives usually recommended?

Cat doesn't recommend any additives; they are already in the lubricant.

What have been the major technological changes to transmission design in recent years and how have these affected the maintenance and upkeep of transmissions?

As the expectations of life and durability of machines increase, Caterpillar engineers have responded by making many mechanical and electrical changes that allow increased productivity and longer life of your product. However, these changes require smaller tolerances and increases in pressure in your machine that make maintenance and the upkeep of your transmission essential. Because these mechanical and electrical changes are advanced, they often require unique testing and repair that only Barloworld Equipment can provide accurately.

When a company with a diverse fleet uses just one or two lubricating oils, what is the effect?

Using the incorrect lubricating oil can cause incorrect pressure, faster wear or slippage.

Are shared oil reserves with implement cylinders (vane or gear pumps) a problem?

Shared oil reserves can cause cross contamination. Newer machines are being designed without them.

Do different types of equipment wear out transmissions at different times? For example, how does a transmission wear in load-and-carry operations vs. stay-at-home operations?

Transmissions do wear out at different intervals due to the applications they are in. If you are constantly shifting from gear to gear or from forward to reverse, your clutches and gears may wear out faster.

Can cutting open a filter help you diagnose a problem?

Yes. Cutting open a filter is very important to determine the root cause of a problem. By finding pieces of metal in the filter, you can determine what is failing. (Refer to the filter discussion under the Planned Maintenance section.)

What happens to the transmission when fluid becomes too hot?

The transmission oil additives deteriorate and lose their ability to control wear. Oil samples results will show high oxidation and an increase in viscosity.

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Barloworld Equipment CAT

BEARING MAINTENANCE

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Bearing Maintenance

An Introduction

Caterpillar is known for having products that provide exceptional performance, extraordinary durability and long life. Caterpillar bearings offer just that and more. Bearings are used in every drive train component and virtually every mechanical component of Caterpillar machines. But because of the varying speed, power, and torque and thrust force going through the drive train, one type of bearing does not meet all the rigorous demands. Several types of bearings are needed, with each bearing being highly crafted and precisely matched to the kind of load it carries.

Bearings serve to allow parts to move together smoothly with minimum friction, heat and wear, often under extreme loads.

Caterpillar offers two fundamental types of bearings: plain (bushing) and anti-friction. This section will focus on antifriction bearings, which use balls and rollers as the primary elements between contacting surfaces.

Anti-friction bearings consist of spherical or cylindrical elements held in races that rotate with the adjoining surfaces, preventing metal-to-metal contact and ultimately reducing friction, heat and wear. Caterpillar offers a variety of different antifriction bearings: ball bearings, roller bearings and needle bearings. All three types of bearings have similar components: hardened steel rings called races, and optional separators or cages, which provide spacing for the rolling elements between the races. In some applications, the rolling elements are in direct contact with the shaft or other mounting.

It is evident that bearings play a critical role in safe and reliable equipment operation. A bearing failure can cause metal particles to enter the machine's lubrication system, wearing gear teeth and ultimately damaging the components. Thus, maintaining high quality operating conditions for the bearings will minimise repair costs and downtime.

The importance of lubrication

Lubrication is an important factor in bearing maintenance. Lubrication supplies an oil film for balls and rollers, reducing friction between bearing components while providing a protective coating to prevent rust, and transports heat away. Using the appropriate quality, type and viscosity of lubricant is vital to good bearing performance and life.

Over-lubricating can lead to churning, causing friction and heat, which eventually initiates premature failure. Lack of lubricant can be harmful, given that not enough oil will be available to do the job. To ensure optimum bearing performance, Caterpillar offers a full line of Cat lubricants to meet your everyday needs.

In splash lubrication systems, such as in final drives, it is imperative to retain the right type and quantity of lubricant in the housing, and to change the lubricant and filters at recommended intervals. Using lubricant rated for the proper temperature must also be noted. When operating at extreme temperatures, it can lead to oxidising the oil and breaking down of additives.

Regardless of the type of lubrication system you are using, be sure to understand and follow the manufacturer's recommendations to establish the right type and frequency of lubrication that is needed for your specific bearing design and application. Additionally, set up an S·O·S oil analysis programme for your machines if one has not already been put in place. This programme can easily help identify abnormal wear prior to it becoming a major problem.

Thorough inspection

Detecting defects and deterioration before failure involves periodically removing, cleaning and inspecting the bearings. Remove bearings carefully as they can easily be damaged during this removal procedure. (See 'Frequently Asked Questions'.) It is important to note that you should always use recommended tools and adhere to the outlined procedures in the machine's service manual. Avoid harmful removal procedures, such as flame cutting inner races or shrinking outer races with weld bead if possible. Using these practices can result in uncontrolled heat that can damage housings or shafts.

When the removal process is complete, bearings should always be cleaned before inspection. Follow Cat's recommended guidelines to ensure the bearings are not damaged. Only use petroleum solvents that are suggested for washing. It is important to remember that most solvents are flammable and toxic when inhaled or absorbed into the skin. Handle with caution.

When choosing whether to replace or reuse a bearing, consider the load, application, and the number of service hours.

To prevent contamination, clean bearings in a container that is large enough for the bearings to be splashed around without contacting the bottom where the dirt settles.

Allow the bearings to soak for an extended period of time to loosen grease and dirt: possibly several hours or overnight. Use a short bristled brush that will not lose or break off its bristles. After visually inspecting the bearing to see that all dirt has been removed, rinse the bearing in a container of clean solvent; next dip the bearing in oil.

When drying the bearing, notice you should not use compressed air to spin it dry. This can cause a non-lubricated bearing surface to be damaged. To dry the bearing, hold both inner and outer races together to avoid spinning and blow air through the bearing.

After the bearing has gone through the cleaning process, examine it thoroughly for cracks in the race, dented seals, and damaged or broken separators, balls, or rollers. If a brownish-blue or bluish-black colour appears, it means the bearing has been overheated. At this point, replace the bearing. If the bearing has a seal or shield, inspect it for damage or wear. If the seals are damaged or worn, you must replace the complete bearing. A worn or damaged seal will permit dirt and moisture to enter the bearing, minimising its wear life.

Check separable bearings for pitted, scratched or flaked balls, rollers or races. If any of these signs are visible, replace the bearing. Inspect the inner surfaces and rolling components in a non-separable bearing by shining a flashlight between the balls and rollers. If you notice any pits, scratches or surface damage replace the bearings.

Further, scan the outer race for proper wear patterns such as wear tracks that are centred without pits or scratches. If you do not visually notice any signs of wear or damage, lightly lubricate the bearing and slowly turn the outer race. Never spin it. If a clicking or sticking is observed, clean the bearing again. If the condition still exists after cleaning, you will need to replace the entire bearing. A thrust bearing or tapered roller bearing can be tested the same way, but place the bearing on a clean surface, lightly apply hand pressure and turn the bearing.

If no signs of wear or damage are indicated and the bearing has low service hours, it can be reused after cleaning. However, if the bearing has high service hours, it is suggested to go with a replacement. This is a precaution due to the fact that the bearing might possibly fail and destroy other critical systems.

Remember that many times it is challenging to determine if a bearing is reusable just by visually inspecting it. Rolling contact stress fatigue originates beneath the surface and cannot be seen. When choosing whether to replace or reuse a bearing, consider the load, application, and the number of service hours. In most situations, it is more economical to replace a bearing that is in severe applications, under heavy load, or has high service hours.

Note that if you are not planning on reinstalling the inspected bearing immediately, perform the following steps: oil the bearing, wrap it in clean, oil proof paper, place it in a box and store it in a dry, dust-free place. These precautions will help avoid corroding and shortening of the bearing life.

Hints on replacement

Any time during inspection you decide to replace a bearing, be sure you replace it with a genuine Cat bearing. Only then are you assured of the proper performance and long life of your machine.

Bearings must be compatible with the machine in the areas of lubrication, fit, surface and load carrying ability. Many times a bearing will look like an original, yet it might not be a correct replacement. Bearings that are not compatible in all areas can fail prematurely.

Cat equipment requires the use of many specialised bearings. Some bearings are imprinted with the manufacturer's code that supplies information on the bearing's general dimensions. Cat bearings are made specifically for Cat products. Therefore, they have no stamped dimensions. In some cases, even though a bearing might portray the same identification code as a standard bearing, it might be unique and have the ability to provide longer life in certain applications.

For example, a bearing could have a particular surface finish or heat treat, or possibly include a different roller crown or cage design. It is vital that you avoid using a standard bearing when a special bearing is specified. Selecting the incorrect bearing will shorten the life and can create further damage

Detect, then correct

If you correctly maintain your bearings, they will not incur premature failure. However, they will eventually fail due to rolling contact stress fatigue. A premature failure happens when bearings fail at low hours for causes beyond normal material fatigue. If you identify any signs of possible bearing failure, such as excessive noise and vibration, excessive heat, lubricant loss or shaft resistance to turning, refer to the troubleshooting chart on the following page.

This chart may help you determine the indicators, causes and proper repair options. If the recommended maintenance options do not correct the problem, disassemble the bearing and try to recognise the cause again.

Keep in mind, determining the cause is usually easier said than done. A visual examination may identify the type of damage, but it may not aid it recognising what is causing the problem. Take this situation for example, if a bearing has scored and heat-discoloration on the roller ends, you know it is burned up and needs to be replaced.

Yet, the cause could be linked to various factors, such as insufficient or improper lubrication, improper adjustment or any combination of these factors. For this instance, you should carefully investigate the mounting, installation and parts affecting the bearing operation to decipher the cause of the damage.

Remember, if you merely replace the failed bearing without finding and fixing the root cause, the replacement bearing will most likely endure the same wear and damage as the original.

Maximise the life of your bearings

For any machine to be safe, reliable and productive, proper bearing maintenance is an absolute must. That's because bearings are used in – and affect the performance of – virtually all mechanical components. You could cross your fingers and hope nothing ever goes wrong. Or you could take a proactive approach by eliminating bearing problems before they begin, with prevention and scheduled maintenance programmes that will ultimately minimise repair costs and downtime. And that's what you really want from any machine.

TROUBLESHOOTING CHART		
Problem indicators	**Causes**	**Options**
Excessive Noise and Vibration	Insufficient lubrication	Fill with correct amount of proper lubricant.
	Incorrect lubricant	Use recommended lubricant.
	Defective bearing	Replace bearing.
	Dirt	Replace bearing.
	Corrosion	Replace bearing. Use lubricant that resists corrosion.
	Improper Load	Adjust to specification.
	Misalignment	Determine what is misaligned: housing, shaft, or bores. Shaft may be bent or housing bores not aligned. Replace shaft or housing.
	Bearings fit too loose	Chrome plate or metalise shaft or bore and regrind to specification, replace bearing if seating surfaces are worn.
	Improper mounting	Replace bearing. Correct installation/mounting problem.
Excessive Heat	Insufficient lubrication	Fill with correct amount of proper lubricant.
	Incorrect lubricant	Use recommended lubricant.
	Improper setting	Adjust to specification.
	Misalignment	Determine what is misaligned: housing, shaft, or bores. Shaft may be bent or housing bores not aligned. Replace shaft or housing.
	Lubricant churning	Use less lubricant or use a lower viscosity lubricant. Be sure to use recommended lubricant.
	Spinning race	Either inner or outer race is sliding around its seated surface. Use proper sized components.
Lubricant Loss	Too much grease	Grease to proper level.
	Improper lubricant	Use high-temperature grease.
	Leakage through seal	Replace seal. Check shaft for scratches or burrs that may have damaged seal.
Shaft Resistant to Turning	Incorrect lubricant	Use recommended lubricant.
	Dirt	Clean bearing. Replace seals and bearing if damaged.
	Corrosion	Replace bearing. Use lubricant that resists corrosion.
	Improper setting	Adjust to specification.
	Lack of lubrication	Add proper lubricant. Check for damage.
	Seal tight	Use proper size and type of seal.
	Bearing cocked	If new installation, remove bearing and clean all mating surfaces. Reinstall bearing if not damaged.
	Leakage between bearings caps and housing	Replace gasket.

Frequently asked questions

What tools do I need to perform proper maintenance of bearings?

You should always work with clean, recommended or approved tools. Do not use a wooden mallet. Also work in clean surroundings, such as on a metal or a metal-covered bench.

How should I properly handle a bearing?

Always handle the bearings with clean, dry hands or even clean canvas gloves. Never hold a bearing with dirty or moist hands, as contamination can easily be transmitted to the bearing. When you are finished handling the bearing, lay the bearing out on a clean surface.

What should I use to clean a bearing?

To clean a bearing you should use uncontaminated solvents and flushing oils. If it is necessary to wipe the bearing, only use clean lint-free rags. It is important to note that you should never use cotton waste or dirty rags to wipe a bearing. Further, never use the same container for both cleaning and final rinse of used bearings.

What is the technique I should use to dry a bearing?

To dry a bearing, hold both the inner and outer races together and blow air through the bearing. You should never spin any bearing with compressed air.

How should I store a bearing?

When storing a bearing, remember the most important factor is protecting the bearing from dirt and moisture. You should be sure to keep the bearing wrapped in oil proof paper. Be sure that you do not scratch or nick bearing surfaces while handling and storing the bearing.

What should I know about installing bearings?

When installing a new bearing, install the bearing as it comes from the package, without washing if it was received in a clean container. When installing used bearings you should thoroughly clean the inside of the housing prior to the installation process.

What should I know about lubricants?

Lubricants are a critical aspect of bearing maintenance. It is vital that you always keep lubricants clean when applying them, and cover the containers when not in use. Further, always use the correct type and amount of lubrication, as this will play a key role in bearing wear life.

A worn or damaged seal will permit dirt and moisture to enter the bearing, minimising its wear life.

Ten factors causing premature failure

Overloading is an especially common factor in premature bearing failure. Overloading causes the oil to generate heat, which affects the oil viscosity. Heat will cause the oil viscosity to decrease and make the lube film thin, allowing contact between the rolling components and raceway.

The contact can cause damage similar to the damage caused by insufficient lubrication.

Caterpillar's Solution: Caterpillar bearings are designed as an integral part of the total machine system. By always using genuine Cat parts, you will ensure the integrity of those systems and provide high performance and long life, especially under high load applications.

2. Improper Lubrication

As mentioned before, proper lubrication is vital to high-quality bearing performance and service life. Insufficient lubrication allows for metal-to-metal contact of the major elements and especially of the roller end against the rib, producing scoring in these areas.

Heat has the ability to turn various elements and roller ends dark blue, or perhaps in extreme cases, black.

Caterpillar's Solution: In applications where inadequate lubrication is a concern, Caterpillar uses a proprietary bearing technology called "textured" bearings. Texturing allows for better oil retention on the contact surfaces which leads to longer bearing life especially in high load, slow speed applications.

3. Contamination

Contamination is any foreign substance that has the ability to damage a bearing. Moisture, dirt, sand or any type of abrasive material will cause premature bearing breakdown. It is important to be able to recognise symptoms of contamination, such as scratching, scoring, brushing, pitting, grooving, bruising, matte or satin finish or rust. Several causes of contamination involve debris manufactured into the system, cracked housings or hoses, dirt access through failed seals, minute metal particles and contaminated lubricant.

Caterpillar's Solution: When contamination is an issue, Caterpillar offers "debris resistant" bearings. These bearings utilise a combination of specialised material and heat treat to produce bearings that are extremely resilient to debris and contaminants in the oil.

4. Distortion

When the housing or shaft is out of round, the bearing roller components are forced together where there is a minimum amount of clearance. The heightened pressure can result in the race and other rolling elements to incur surface flaking, something that typically happens with normal fatigue.

Caterpillar's Solution: see "Improper Fit"

5. Misalignment

To maximise bearing life, the supporting seats and shoulders must meet manufacturer's specific limits. If the misalignment is beyond those particular limits, the load on the bearing will be intense on only a segment of the roller and races, causing excessive stress and premature failure at that single point.

Caterpillar's Solution: Caterpillar's specialised roller profile provides optimum load distribution across the bearing, even when misalignment is present. This serves to minimise stress in the bearing and maximise bearing life.

6. Improper Fit

Having proper bearing fit is essential to capitalising on bearing performance and life. A variety of improper fits can cause significant damage, including forcing a bearing onto a shaft that is too large for the inside diameter of the bearing race, fitting an outer race insecurely (too loose) in its housing and having a loose fit between the shaft and the inside bore of the bearing. These inadequate fits can cause split races, fretting corrosion and creep wear.

Caterpillar's Solution: Caterpillar bearings are made with specialised tolerances for precise fit of the bearing to the shaft or housing and ensures exact positioning of related parts.

7. Vibration Damage

Anti-friction bearings must roll while under a load. Subsequently, subjecting a bearing to vibration while it remains immobile can cause depressions on the race from fretting.

Caterpillar's Solution: In Caterpillar bearings, eliminating vibration is a prime factor in determining the type of bearing cage required. Brass cages and non-metallic bearing cages are two types which minimise vibration and provide maximum life in harsh applications.

8. Defects in Material

Defects in antifriction bearings are particularly rare, especially when it comes to the material, forming, machining, heat treat, grinding and assembly difficulties. The minimisation of defects is a result of the extreme cleanliness of bearing steels and stringent quality control measures used in manufacturing facilities that supply Caterpillar bearings. Note that usually only a metallurgist can characterise these types of defects from other causes of premature failures.

Caterpillar's Solution: Caterpillar bearings are manufactured to the highest material quality standards in the industry and will always provide for the optimum performance and component life of Cat machines.

9. Improper Servicing Techniques

It is critical to always follow the manufacturer's recommendations summarised in your service manual. Further, this means using the proper tools. Using inappropriate tools and procedures when removing, installing and handling bearings can cause damage and possibly failure.

Caterpillar's Solution: Always refer to your Cat equipment's Operation and Maintenance Manual and other service literature for proper procedures and servicing techniques.

10. Electrical Current

Bearings pass electrical currents that initiate an arcing and burning at the points of contact between the races and rollers. This may produce a single burn or multiple grooves called "fluting." A burned bearing allows for excessive noise and will need to be replaced.

Caterpillar's Solution: Be sure to find and repair the root cause of the electrical ground to avoid damage to the new bearing.

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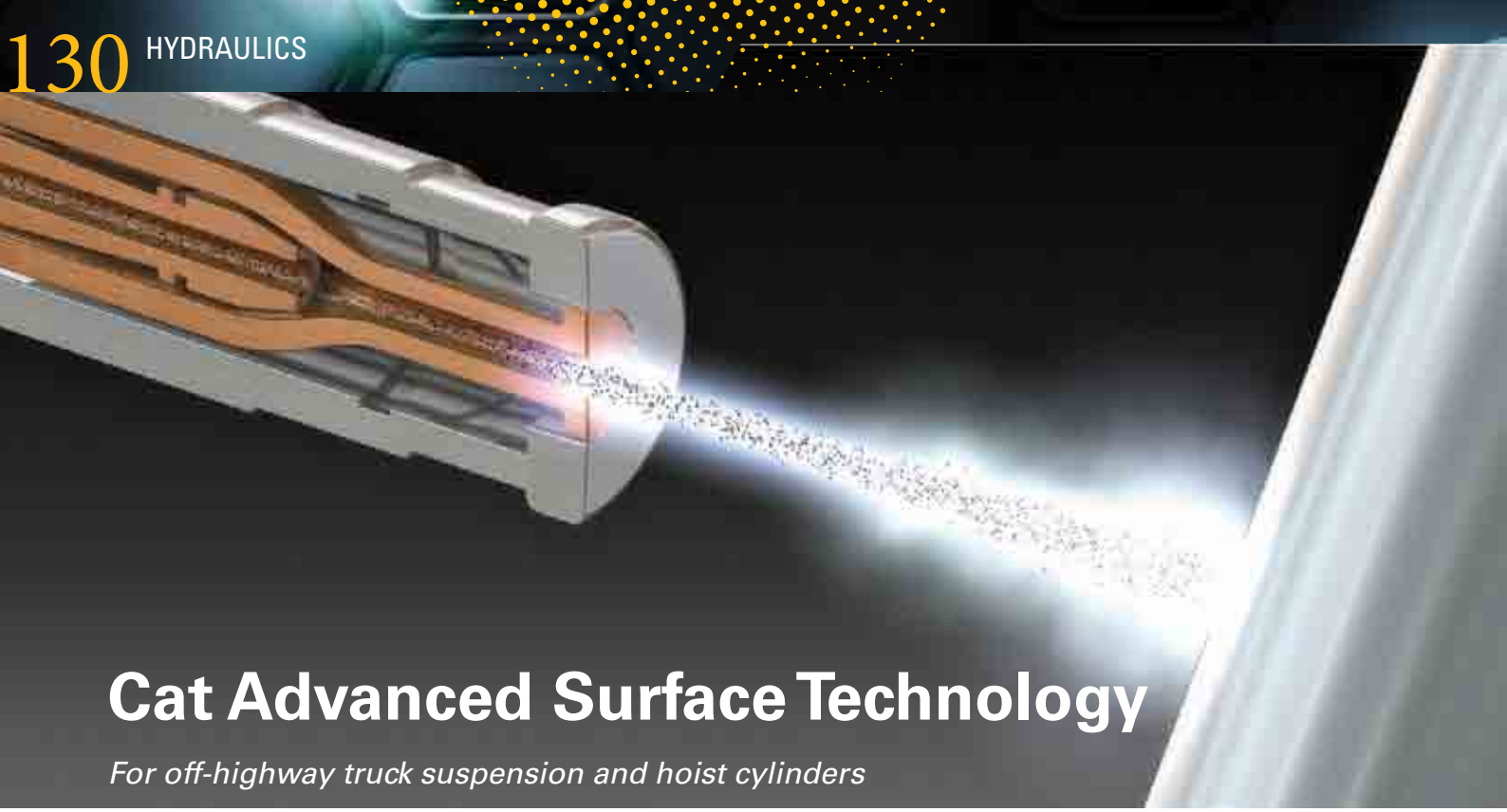


Cat Advanced Surface Technology

For off-highway truck suspension and hoist cylinders

Reman rods with Cat AST available to support Cat F-Series off-highway trucks

Introduced on the Cat F-Series off-highway trucks, Cat Advanced Surface Technology (AST) coated rods offer several advantages over traditional chrome-plated rods.

Benefits:

- They can last up to three times as long in the same application.
- Offer better wear resistance.
- Are more environmentally friendly.

Superior wear characteristics and improved component durability mean longer seal life, reduced downtime, and improved machine availability and productivity.

Because many of these rods are compatible to earlier models, Caterpillar is offering an "upgrade-to-AST" option. Owners of older Cat trucks interested in upgrading to Cat AST Reman Rods will receive core credit for their existing rods.

How Cat AST works

Here's how the Cat Advanced Surface Technology process works:

- Salvaged components undergo straightening.
- New and salvaged components undergo grit-blasting to prepare and clean the surface for the thermal spray.
- Hot combustion gases near 2 760°C are channelled and combined with a fine metal powder, and accelerated through a nozzle at more than three times the speed of sound. This forms a stronger mechanical bond than chrome plating.
- The surface is ground to like-new specifications.
- A final grinding operation gives the surface a super-fine polish.

Superior wear characteristics

Because the metal alloy coating created by Cat AST is harder than chrome plating, it provides greater resistance to scratching and therefore helps prevent contaminants from entering the system. The Cat AST surface is also denser, allowing it to extend component life. The process is good for the environment, as Cat AST byproducts can be recycled or reused.

• Suspension Cylinder Rods • Hoist Cylinder Rods • • Hoist Cylinder Groups •

Models

• 769/771D • 770/772 • 773/775F • 777F • • LOHT: 785 – 797 •

Hydraulic Cylinder Rod Seals

When it is time for repairs, you should not overlook any part, regardless of size. Even parts as small as seals have a big impact on machine performance, contamination control and operating costs. That's why selecting the right seals is so important and why Caterpillar is dedicated to designing the best-performing seals in the industry.

Cat rod seals are designed to work together to deliver optimum sealing performance and lower operating costs in Cat hydraulic systems, something you risk when purchasing other brands of seals. All Cat rod seals – wiper, U-cup and buffer – feature a proprietary urethane material and patented designs.

When you need new hydraulic cylinder rod seals, don't install doubt. Turn to us for genuine Cat seals. Discover the difference better designs and better material make.

Wiper Seal

Cat wiper seals feature a patented double-lip design that provides optimum contact with the rod to keep out contaminants. Also, vents moulded into the radius of the internal lip help prevent these seals from unseating themselves during operation.

U-cup Seal

Cat U-cup seals also feature a double lip. This design ensures uniform contact of the oil-sealing lip, helping deliver top performance and wear life. Cat U-cup seals work together with the buffer seals to optimise sealing performance while minimising pressure build-up.

Buffer Seal

Cat buffer seals last longer because they are designed to be pressure-activated. Unlike compression buffer seals, these Cat seals exert pressure on the rod only when necessary. And because vents provide a passage for high pressure to be relieved back into the cylinder, Cat buffer seals minimise pressure build-up, reducing U-cup failure.

Better Design

Cat wiper, U-cup and buffer seals feature design improvements that enhance performance, reduce leakage and increase seal life.

Better Material

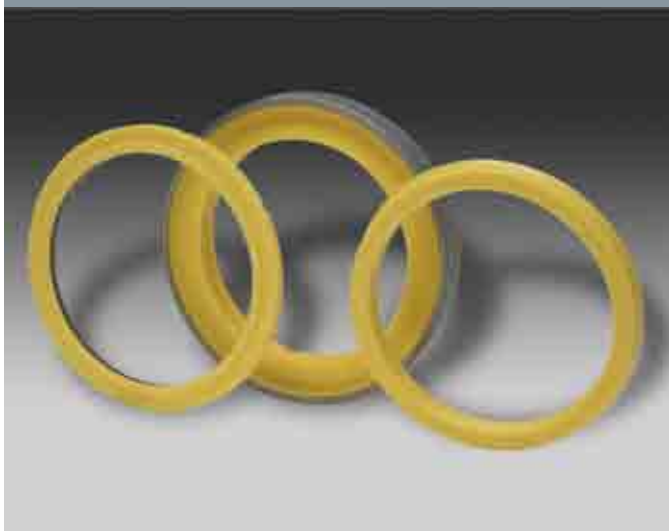
Cat hydraulic cylinder rod seals feature a proprietary urethane material that delivers improved performance over the material used in previous seals. This proprietary material provides:

- ***Better compression set***
  Compression set measures a material's ability to rebound to its original shape after compression. Cat urethane material offers up to a 25% improvement in compression set capabilities over previous materials, without sacrificing tensile strength or seal hardness levels.

- ***Wider temperature application***
  Cat hydraulic cylinder rod seals can work in a wider range of operating temperatures than previous designs, without seal degradation.

Better Value

At Barloworld Equipment's service centres, resealing hydraulic cylinders involves more than installing new seals. To help you get the full life of the new seals, we light hone cylinder tubes. We also practice contamination control, have tooling for proper disassembly and assembly, reassemble to Cat specs, and have pressure test capability



Cat wiper, U-Cup and buffer seals are designed to work together to provide optimum sealing performance in Cat hydraulic systems.

Hydraulic Cylinder Reseal Service

Count on our expertise to stop leaks and maximise system performance

Our Barloworld Equipment service team is committed to resealing hydraulic cylinders quickly and correctly the first time. That means using proper disassembly and assembly procedures, honing cylinder tubes, practicing contamination control, and installing the industry's best hydraulic seals. We even check for other problems – such as dented or scored rods – and we pressure test each resealed cylinder.

There's a lot more to resealing hydraulic cylinders than just installing new seals. Find out how we can help you keep your costs low and your cylinders performing at peak efficiency.

Five reasons we're your best choice for hydraulic cylinder reseal service:

Proper disassembly and assembly

Without the proper tooling, completing the repair can take much longer. You also risk damaging reusable parts or ruining the cylinder group. We use tooling designed to disassemble and assemble cylinders quickly, without damaging components.

Light honing

We light hone cylinder tubes to remove minor scratches and other hard-to-see imperfections that quickly damage newly installed piston seals and piston wear bands. This procedure, in conjunction with proper contamination control practices, substantially increases the life of new hydraulic cylinder seals.

Contamination control

Worn seals allow contamination to enter the hydraulic cylinder. These contaminants can damage newly installed seals – or worse, damage other system components such as pumps or valves. We clean cylinder components and wash out any contaminants before re-assembling the group.

Cat seals and seal kits

Caterpillar is dedicated to designing the best-performing seals in the industry. That's why we reseal hydraulic cylinders with genuine Cat seals and money-saving seal kits. Cat seals are specifically designed to handle the increasing pressures and temperatures of today's hydraulic cylinders. Don't risk poor performance or leaks, use seals that carry the Caterpillar name.

Quality assurance

We pressure test each hydraulic cylinder before returning it to you, helping ensure reliable on-the-job performance.

Other ways our hydraulic service can save you time and money

Resealing hydraulic cylinders quickly and effectively is just one of the many ways we can help you lower your operating costs and improve your hydraulic system's performance.

We'll show you our wide range of repair options – including Cat Reman components – and explain how we can help you get maximum machine productivity at the lowest possible cost.

Hydraulic Cylinder Seals Kits

It's frustrating to open a seal kit and find it contains too many, too few, or the wrong seals. Cat hydraulic cylinder seal kits are designed to provide the exact seals you need. The key is ordering the right seal kit.

Occasionally, Caterpillar changes the design of a cylinder group in production. Sometimes these changes result in a new cylinder group part number. Other times the part number stays the same and a new "engineering change level" is assigned. This makes it possible for multiple seal kits to service the same cylinder group. Therefore, when ordering a seal kit you need to know both the cylinder group part number and its engineering change level. Speak to your Barloworld Equipment customer service representative for expert advice.

Contents and packaging help ensure quality and ease of use

Cat hydraulic cylinder seal kits contain genuine Cat seals, many of which feature proprietary urethane material and patented designs for superior compression set and broader temperature applications. All are matched to your application, helping ensure top performance and long wear life. Kits themselves are carefully packaged to keep contamination out, and they include a list of the contents, installation instructions, and the engineering change level. For more information, contact us today or visit the Cat website (www.cat.com).

With Cat hydraulic cylinder seal kits, you receive all the seals you need – and only the right ones for your application. There's no waste or confusion, saving you time and money.

Light honing optimises seal performance and life

Restoring the proper geometry and surface to the cylinder bore can keep you from replacing seals earlier than necessary. That's why before we install new cylinder seals in our workshop we perform a simple procedure called light honing. Light honing detects and corrects minor damage to the cylinder bore that left unchecked wears out internal seals and eventually causes leaks inside the system.

Easy-to-use kits simplify Cat cylinder repairs

- ***Convenience:*** One part number gets you all the right seals for your application, no more, no less.
- ***Quality:*** Cat seal kits contain genuine Cat hydraulic cylinder seals, matched to specific applications for durability and long wear life.
- ***Protection:*** Careful packaging helps ensure seals are protected from contaminants that can reduce hydraulic system performance.
- ***Value:*** Available off-the-shelf for most cylinder applications, Cat seal kits cost less than ordering the seals individually.

To ensure correct seal kit selection, locate the cylinder group part number and engineering change level on the outside of the cylinder.

Cat Hose Service

Fast, Dependable, Certified Clean

Superior Cat hose products: Barloworld Equipment hydraulics centres build hoses from their large inventory of Cat high, medium and low-pressure hoses and couplings. These products are designed, built and tested as a system by Caterpillar to exceed industry requirements.

Certified Crimp: Our hydraulics technicians visually and dimensionally check crimps to make sure they meet specifications. Over and under crimped hoses can be detrimental to both hose performance and safety.

Certified Clean: We use a state-of-the-art process to remove contaminants created during the cutting and crimping of hoses. If left inside hoses, these contaminants can damage cylinders, pumps and other hydraulic system components. We also cap the ends of hoses to help prevent contaminant ingress prior to installation.

The benefits:

- One part number makes ordering hoses for Cat equipment quick and easy.
- Hoses are assembled to original specifications by trained Barloworld Equipment technicians.
- Use of superior Cat hose products.
- Certified Clean.
- Certified Crimp.
- While you wait service for Cat and other equipment brands.
- On-site support for remote sites.

Barloworld Equipment technicians pneumatically clean hoses with foam projectiles to remove contaminants that can damage hydraulic system components.

Work hard, Play hard.

Visit our Cat® clothing store for a wide range of quality Cat clothing, shoes and merchandise. **For more information call 011 929 0067 or email pselebi@barloworld-equipment.com**

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Barloworld Equipment CAT

No-Skive Couplings: Added Flexibility

When Caterpillar first announced its decision to move away from the Cat reusable coupling system and introduce the No-Skive coupling series many people were apprehensive about the change. After all, Cat reusable couplings have been around since the late 60's; they have also been the only high pressure reusable coupling system on the market for many years.

Once seen in operation, though, customers soon appreciate that this latest Caterpillar R & D innovation is designed with the express purpose of improving efficiencies still further.

No-Skive couplings satisfy the requirements for Cat XT-3, XT-5 and XT-6ES and ToughGuard ™ hoses.

No-Skive: Designed to lower inventory holdings

Cat XT No-Skive couplings provide several benefits, a key one being lower inventory requirements. That's because each No-Skive coupling satisfies the requirements for Cat XT-3, XT-5 and XT-6ES and ToughGuard ™ hoses.

Additionally, as the name implies, No-Skive couplings eliminate the need for the hose to be skived prior to assembly. In addition to reducing labour and assembly time, it also reduces the chance for installation error and system contamination from rubber particles.

XT No-Skive couplings can be pushed on by hand in the Dash 6 and Dash 8 sizes while maintaining enough grip to ensure orientation placement, all while eliminating the need for a pusher. The swaged nut and improved plating process on each coupling results in more consistent torque readings and easier hose assembly installation.

Previously you could only use an XT-3ES coupling on an XT-3ES hose and the same applied with Caterpillar XT-5ES and XT-6ES hoses. This meant having to carry one coupling for each pressure hose. Now, however, with the new No-Skive innovation one coupling will fit on all three hose pressure ratings.

In addition to the No-Skive series, Barloworld Equipment's hose service centres across southern Africa provide full support for all machines fitted with Cat reusable couplings.

Reusable Couplings For Cat XT Hose

Cat reusable couplings for XT™ hose feature a unique two-piece design that allows you to reuse the couplings. When you need to replace worn hose, we just take off the coupling, install the new hose, and reattach the coupling. We'll have your repaired hose assembly ready fast, so you can get back to work quickly.

On new Cat machine models, Caterpillar has discontinued the Reuseable Coupling series and replaced it with the No-Skive Coupling Series. (See above)

On-Site Hose Support: A Novel Container Service

When and where you need it.

For mines and contractors operating on remote sites, the introduction of Barloworld Equipment's hydraulic hose assembly container service cuts out part delivery lead times and ensures fast and efficient maintenance. On the spot hose changes mean there's minimal machine downtime and all tooling meets the requirements for Cat no-skive and reusable couplings.

Catering for low, medium or high pressure applications, hose and coupling inventories are customized to match the client's machine population for both Cat and other OEM products.

The purpose-built 40 foot high-rise container comes equipped with the latest Caterpillar technologies and is manned and managed on-site by Barloworld Equipment Parts Department personnel that include trained hose assemblers. Ongoing inventory management ensures that replacement parts are always available.

Standard for each container configuration are features that include an air conditioning system; an office area; and ISO electrical points with lock-out.

Hose tooling comprises a Cat S6.2 radial press with the Series (III) Crimputer permanent coupling software set-up for no-skive products; an XT press for all reusable coupling changes; a fully ventilated hose cutter; a workbench with vice; a contamination control cupboard; storage shelving; and hose reel racking.

The container's easy portability also means that the unit can be loaded onto a truck and moved from site to site, when required.

The container's easy portability also means that the unit can be loaded onto a truck and moved from site to site, when required.

Each purpose-built 40 foot high-rise container comes equipped with the latest Caterpillar technologies.

Cat XT™ ES (Enhanced Spiral) hose has an exclusive cover which is formulated and manufactured by Caterpillar to provide up to 20 times more abrasion resistance than industry-standard hose.

Cat Toughguard™ Hose

The standard in hose performance

Cover abrasion is the leading cause of hydraulic hose failure, which in turn has downstream impacts on machine availability and productivity.

Caterpillar's research and development team has responded with the ToughGuard series, designed for XT™ ES (Enhanced Spiral) hose. Engineered to meet the toughest working applications, ToughGuard covers provide up to 20 times more abrasion resistance than industry-standard hose, as confirmed by ISO abrasion-resistance testing. (This ISO test requires a 50N steel tool to be cycled back and forth along the length of the hose until the cover wears away to the point of wire exposure.)

ToughGuard: built to last

Each ToughGuard hose features a polyethylene exterior that provides increased resistance to abrasion caused by hoses rubbing together or against other abrasive materials. Additionally, this cover:

- Eliminates the need for nylon or plastic add-on protection in most applications.
- Does not sacrifice minimum bend performance.
- Offers protection against chemicals and weathering.
- Is compatible with both Cat XT No-Skive and Cat XT ES Reusable Couplings.
- Uses existing clips and grommets.
- Has been tested to two million abrasion cycles without failure.

Besides helping to increase machine uptime, Cat ToughGuard hose significantly reduces material and labour costs associated with other hose-protection options.

More flexibility

Cat XT ES hose works at half of the SAE's bend radius, allowing tighter routing, without sacrificing cold flex capability. These attributes, plus superior reliability, make Cat XT ES hose the preferred choice in a variety of machines and applications.

Cat Toughguard™ Hose
Continued

XT-3 ES HOSE				
EXCEEDS SAE 100R12 STANDARDS				
Part No.	**Hose I.D. in (mm)**	**Hose Dash Size**	**Max. Work Pressure psi (kPa)**	**Min. Bend Radius* in (mm)**
238-8337	0.375 (9.5)	-6	4,000 (28,000)	2.50 (64)
238-8339	0.500 (12.7)	-8	4,000 (28,000)	3.50 (89)
238-8340	0.625 (15.9)	-10	4,000 (28,000)	4.00 (102)
238-8341	0.750 (19.1)	-12	4,000 (28,000)	4.75 (121)
238-8342	1.000 (25.4)	-16	4,000 (28,000)	6.00 (153)
245-1420	1.250 (31.8)	-20	3,000 (21,000)	8.25 (210)
245-1421	1.500 (38.1)	-24	2,500 (17,500)	10.00 (254)
256-1390	2.000 (50.8)	-32	2,500 (17,500)	12.50 (318)

XT-5 ES				
EXCEEDS SAE 100R13 STANDARDS				
Part No.	**Hose I.D. in (mm)**	**Hose Dash Size**	**Max. Work Pressure psi (kPa)**	**Min. Bend Radius* in (mm)**
293-4616	0.750 (19.1)	-12	5,000 (34,474)	4.76 (141)
293-4617	1.000 (25.4)	-16	5,000 (34,474)	6.02 (153)
293-4618	1.250 (31.8)	-20	5,000 (34,474)	8.27 (210)
293-4619	1.500 (38.1)	-24	5,000 (34,474)	9.99 (254)
5P-8358	2.000 (50.8)	-32	5,000 (34,474)	12.52 (318)

XT-6 ES HOSE				
EXCEEDS SAE 100R15 STANDARDS				
Part No.	**Hose I.D. in (mm)**	**Hose Dash Size**	**Max. Work Pressure psi (kPa)**	**Min. Bend Radius* in (mm)**
238-8343	0.375 (9.5)	-6	6,000 (41,370)	3.00 (76)
238-8344	0.500 (12.7)	-8	6,000 (41,370)	4.00 (101)
238-8346	0.750 (19.1)	-12	6,000 (41,370)	5.25 (133)
238-8347	1.000 (25.4)	-16	6,000 (41,370)	6.50 (165)
245-1412	1.250 (31.8)	-20	6,000 (41,370)	8.75 (222)
245-1413	1.500 (38.1)	-24	6,000 (41,370)	10.50 (267)
222-4844	2.000 (50.8)	-32	6,000 (41,370)	25.98 (660)

Custom Hydraulic Service

For peak performance and profitability

Custom Hydraulic Service (CHS) is a detailed inspection programme available through Barloworld Equipment that is designed to keep today's hydraulics-intensive machines operating at peak performance.

Studies show that hydraulic system efficiency can fall off by as much as 20% before being detected by operators.

Today's hydraulic systems operate with higher pressures and tighter tolerances that demand attention to contamination control. Dirt and other contaminants allowed to enter the system accelerate parts wear. Along with higher service costs, premature wear can also cause a loss of performance that may go undetected for a long time.

CHS Inspections

Recommended annually or every 2 000 hours, CHS inspections performed by Barloworld Equipment technicians include:

Performance tests:
- Engine performance.
- Hydraulic cylinder drift.
- Hydraulic system cycle times and pressure.

Visual inspection checks:
- Hydraulic system.
- Engine and cooling system.
- Cab.
- Electrical system.
- Undercarriage.
- Ground Engaging Tools.

SOS Fluids Analysis:
- Extraction of oil sample from the hydraulic compartment.
- Analysis of oil sample to determine contamination level, physical properties and wear material count.

Corrective action recommendations:
- Analyse results of performance test, oil analysis and visual inspection.
- Provide a detailed report.
- Recommend repairs if needed, as well as changes to the maintenance schedule.

Custom Hydraulic Service inspections identify when a machine's hydraulics are not performing up to par and enable corrective action to be taken.

Cat O-Rings

Matched to your Cat system and designed for maximum seal life in demanding applications

Cat O-ring materials are specifically selected based on the different fluids, and fluid temperatures, in Cat engines and machines. Seal material hardness is matched to the different fluid system pressures to maintain proper sealing force, as well as minimise seal extrusion and seal abrasion. In addition, some Cat O-rings have special coatings, like PTFE, to minimise friction and ensure proper seal installation in tight seal grooves.

Precise seal dimensions help ensure Cat O-ring seals fit properly into Cat seal grooves without damage to the seal, and there are unique Cat O-ring sizes designed for use in special applications where SAE standard sizes won't perform well.

Packaged to save you time and money

Caterpillar offers several O-ring seal kits, saving you time and up to 15 percent off the cost of ordering O-rings individually. Seven different kits are available for hydraulic fittings and air-conditioning systems.

Contact your Barloworld Equipment customer service representative for more information on the range of Cat O-rings available for your Cat equipment and other applications.

Cat Refillable O-Ring Seal Kits

When you replace Cat hoses and tubes, it's important to have the right O-rings at your fingertips, which is where Cat refillable O-ring seal kits prove invaluable.

Stored in durable carry cases, Cat seal kits have individual compartments to store a variety of seal sizes.

Caterpillar offers two types of application-specific seals: Standard Nitrile (NBR) and Fluorocarbon (FKM) rubber, made specifically for high-performance Cat hydraulic systems. Every O-ring Caterpillar makes meets specific material and dimensional requirements.

Seal kits for speciality applications cater for air conditioning fittings, plus low-pressure, high temperature environments.

Cat Resealable O-Ring Packaging

Available alongside the Cat refillable kit option is Caterpillar's comprehensive range of resealable O-ring packets.

Caterpillar now offers 67 different O-Ring packages to match the most common types of hydraulic adapters and hose fittings, each available in a convenient, contamination-free poly-bag.

For order enquiries, please contact your Barloworld Equipment customer service representative or any one of our Parts Counters nationwide.

CAT O-RING MATERIALS

Material	Hardness
Nitrile Buna Rubber (NBR)	55, 60, 70, 75, 80, 90
Highly Saturated Nitrile Buna Rubber (HNBR)	60, 78
Fluorocarbon Rubber (FKM)	60, 75, 80, 90, 95
Silicone (VMQ)	60, 70
Ethylene Propylene Diene Modified Rubber (EPDM)	50, 70

These are the primary materials used in Cat O-rings. Other materials, in a variety of hardness types, are used in specialty applications.

Maintain your cooling system. High fluid temperatures are the number one cause of shortened seal life.

FKM Advantage

FKM rubber seals are available for O-Ring face seals (ORFS), straight thread O-rings (STORS) and D-rings.

ORFS FKM seals are designed for brake control lines, fuel lines and hydraulic control systems.

STORS FKM seals are designed for fluid fittings and plugs in engines.

D-Ring FKM seals are designed for high-pressure hydraulic systems.

Don't risk expensive components with in-expensive after-market O-rings.

10 O-Ring Tips

1. Keep O-rings packaged until installation.
2. Don't store O-rings near heat.
3. Protect O-rings from UV rays.
4. Remove old O-rings with brass or plastic picks to prevent groove damage.
5. Don't reuse O-rings.
6. Clean the seal groove before installation.
7. Don't soak O-rings.
8. Don't twist or cut O-rings during installation.
9. Don't select O-rings based on material colour. There is no universal colour standard.
10. Maintain your cooling system. High fluid temperatures are the number-one cause of shortened seal life.

Cat Optional High-Temperature FKM Seals

Longer lasting, more heat resistant

Cat FKM rubber seals offer you an upgrade on standard nitrile seals for exceptional high temperature applications. This specially formulated material is available for O-Ring face seals (ORFS), straight thread O-rings (STORS) and D-rings.

Key features:

- Superior heat resistance prevents hardening and ensures sealing quality at extreme temperatures.
- Seal life can be as much as 10 times longer in exceptionally high-temperature working conditions, resulting in less maintenance and fewer replacement seals.
- Resistance to high pressures improves sealing performance and prevents fluid contamination and leaks.
- Seals with PTFE (polytetrafluoroethylene) coating ease installation and prevent tears and damage.

Superior performance in high temperatures

Cat FKM seals are designed to perform optimally in temperatures from -40°C to 175°C. They are an upgrade to nitrile butadine rubber (NBR) seals, which can fail due to high temperatures.

NBR seals can experience hardening and a subsequent loss of sealing capability with prolonged exposure to excessive operating temperatures (above 100° C) near mufflers, aftercoolers and turbochargers.

Longer seal life, less maintenance

In lab tests conducted at 135°C, FKM seals lasted 10 times longer than NBR seals. Longer-lasting seals mean less downtime to replace them, reducing costs.

Improved resistance to high pressure

FKM seals can also be used in Caterpillar high-pressure applications that require improved performance. Increased material strength allows the O-ring to withstand higher pressures without extrusion or "nibbling" on the outside diameter. The FKM seal material has better resistance to "compression set," or loss of sealing force.

Easy installation

FKM ORFS and STORS seals are coated with a light blue coloured polytetrafluoroethylene (PTFE) dry lubricant, which makes seal installation easier. It reduces seal twisting and helps prevent cutting during installation.

Cat Hydraulic Pump and Motor Service

Here are just a few reasons why you can trust us to provide the best value in pump and motor service:

- Trained technicians.
- Caterpillar Parts Reuse Guidelines.
- Comprehensive repair options.
- Commitment to contamination control.
- Performance testing.

Control costs and maximise uptime

- Nobody knows Cat hydraulics like our trained technicians. They have the parts, tooling and expertise to diagnose and resolve problems quickly and accurately.
- Caterpillar provides us with comprehensive Parts Reuse Guidelines developed from decades of Cat dealer repair data. Because we don't replace parts unnecessarily, you contain repair costs and realise the full value from your Cat equipment investment.
- We offer the industry's most comprehensive repair options. More choices means you won't pay for or wait for repairs you don't really need. Off-the-shelf Cat Reman products, section kits and precision lapping are just a few of the options we offer to help you keep your costs and machine downtime to a minimum. We even offer Cat Classic™ pumps, an economical new-part alternative for older Cat equipment.
- Disciplined contamination control procedures help to keep your hydraulic systems clean and operating at peak efficiency.
- Pumps and motors we service are performance-tested before they leave our workshop to make sure they meet factory specifications.

More options save you time and money

Gear-type Pumps and Motors

- Reseal.
- Rebuild.
- Section kit.
- Cat Reman pump.
- New pump/motor.
- Cat Classic™ pump.

Vane-type Pumps and Motors

- Reseal.
- Cat Reman cartridge.
- Cat Reman pump/motor.
- New cartridge.
- New pump/motor.

Piston-type Pumps and Motors

- Reseal.
- Rebuild.
- Precision lapping.
- Cat Reman barrels, port plates and piston assemblies.
- Cat Reman pump/motor.
- New pump/motor.

Cat Remanufactured Hydraulic Components

- Deliver the same performance and life as new Cat components.
- Are backed with a same-as-new parts warranty.
- Offer the broadest line of remanufactured hydraulic components in the industry.
- Are a fraction of the price of new.

The difference is in the details

Caterpillar incorporates the latest engineering updates into all Cat remanufactured hydraulic components.

Reman hydraulic cylinders and rods

- All tubes, rods, and other components are fully remanufactured to Cat specifications or replaced with new Cat parts.
- All rods are induction-hardened, improving resistance to nicks and dents and extending seal life.
- Most rods feature inertia-welded eyes for superior strength.
- All required new bearings are installed.

Reman hydraulic pumps, motors, and components

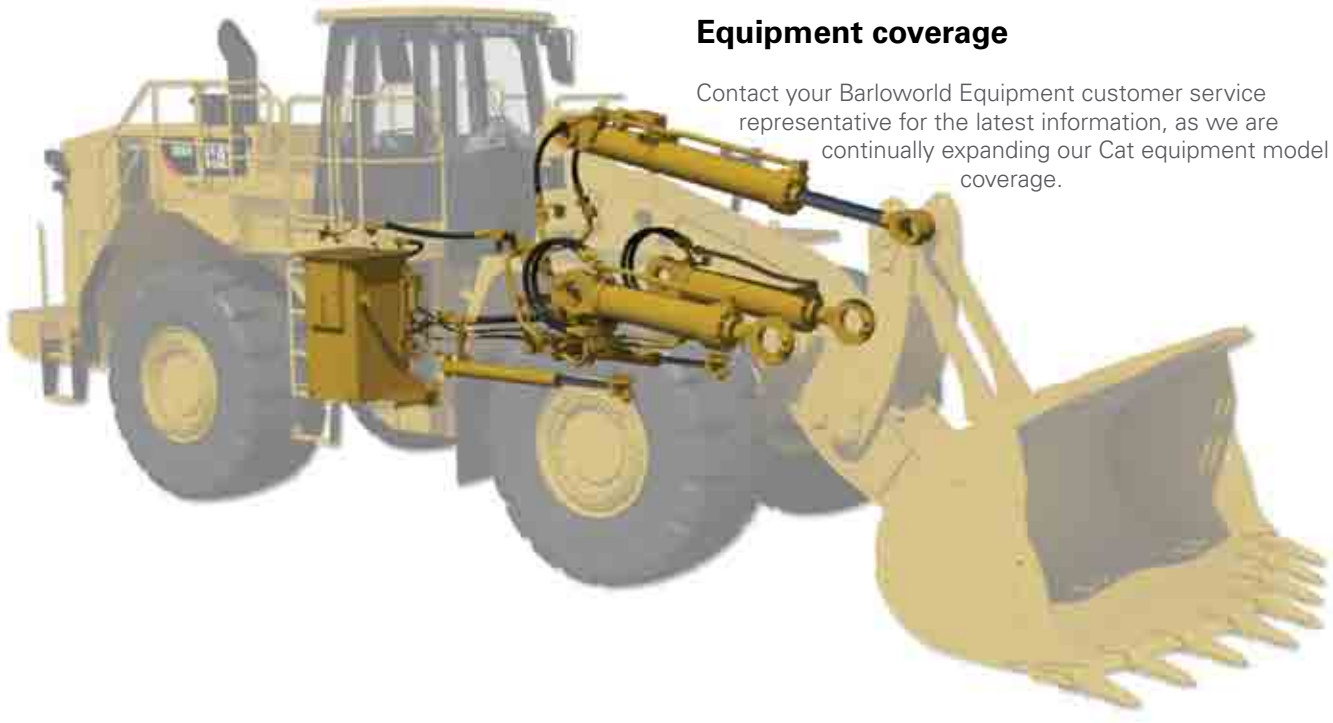
- All returned units are disassembled and thoroughly cleaned and inspected.
- Port plates are reconditioned and updated to the latest designs, or replaced with new parts.
- Piston slippers and pistons are reconditioned or replaced.
- Barrel assembly faces are re-machined, and bushings are replaced and machined to new specifications.
- Vane pump rotors and cams are remanufactured to Cat specifications or replaced with new components.
- Vanes are all replaced with new components.
- All cartridges, pumps, and motors are adjusted and tested to ensure like-new performance.

Core exchanges help reduce your costs

The price of your Cat Reman hydraulic component is based on the condition of your used component, so the better the condition of your core, the more you save. Because Cat hydraulic components are designed to be remanufactured, we can often award credit even when you think a component has no value left. That means the price you pay for Cat Reman cylinders, rods, pumps, and motors is always less than that of new parts.

Equipment coverage

Contact your Barloworld Equipment customer service representative for the latest information, as we are continually expanding our Cat equipment model coverage.



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Cat Flexport™ Tyres

Designed specifically for skid steer loaders and compact, small and medium wheel loaders

Created with operator comfort in mind, Flexport™ tyres use a series of elliptical-shaped ports moulded through the outer ring of the sidewalls. The ports increase tyre flexibility to produce a smoother, more cushioned ride on any surface, from waste and scrap to quarry and glass. The ports won't crush under the weight of a full bucket, and the innovative design also improves machine stability when lifting and carrying.

FLEXPORT: Features and Benefits

- Patented sidewall ports make the ride more comfortable for operators.
- Elliptical ports won't collapse under heavy loads, reducing stress points for longer wear life.
- Greater machine stability when carrying maximum loads.
- Deep tread delivers long wear life and excellent traction on any surface.
- Tread pattern handles tough terrain, and allows easy, smooth transitions from unimproved to improved surfaces.
- Highest quality rubber compound manufactured to Caterpillar specifications means durability for longer wear life and a consistent product.
- Puncture-proof design puts an end to fixing flats.
- One piece tyre-and-rim design reduces tyre servicing costs.

To meet demanding and diverse operating environments, Cat Flexport tyres are available in three different tread patterns:

- Construction.
- Smooth-Tread; and
- OTR (Off the Road).

Construction Tread

The Flexport construction tread design is the right choice for maximum performance in your toughest environments. It is designed for smaller machine applications where better traction is required.

Smooth-Tread

The Flexport smooth-tread design is ideal for special applications where debris is an issue like scrap yards, recycling centres and some waste transfer stations.

Off the Road (OTR)

The OTR design has a block pattern that provides a degree of traction in applications where debris is not an issue.

Cat Flexport tyres are available on new machines and from Barloworld Equipment as service parts. Contact your Barloworld Equipment customer service representative for advice on Flexport tyre sizes to suit your machine and working application.

Flexport tyres for skid steers and compact wheel loaders

Cat Flexport tyres for skid steer loaders are a 1-piece tyre / rim design and are available in directional construction, smooth and OTR tread patterns. For most applications, the machine width can be customised by altering the placement of the rim on the machine.

Flexport tyres for small and medium wheel loaders

Cat Flexport tyres for small and medium wheel loaders are a 2-piece tyre / rim design and are available in smooth and OTR tread patterns.

Installation of a Cat Flexport tyre on either a small or medium wheel loader requires the use of an adapter plate and hardware.

Please note: In certain small and medium wheel loader configurations, Cat Flexport tyres may cause the machine to exceed the Roll Over Protection Structure (ROPS) capacity. To be certain that the machine does not exceed ROPS, the machine should be weighed to verify that the ROPS limits would not be exceeded with Flexport tyres. The ROPS capacity can be found on the cab of the machine.

HEAD-TO-HEAD COMPARISON RESULTS

Caterpillar's Flexport elliptical design far superior to round design

Other tyre companies manufacture tyres with round holes.

- The round design easily collapses into a flat shape under a load, which creates corners that cause "pinch" or "stress" points.
- Stress point damage will typically result in cracking and chunking of a tyre.

Caterpillar designed Flexport Tyres with elliptical-shaped ports.

- Flexport's elliptical ports are designed not to crush when compressed by heavy weight.
- Because the ports don't crush, this reduces stress points – and increases wear life.

Applications	Building & Framing	Demolition	Hammering	Industrial Waste	Landscaping	Loading	Pavement Profiling	Quarry Cleanup	Recycling	Scrap Yard	Transfer Station
Flexport™ Construction	■	■	■	■	■	■	■				
Flexport™ Smooth-Tread		■		■				■	■	■	■
Flexport™ OTR	■	■	■		■	■		■	■	■	■

Flexport Warranty

Cat tyres have a separate warranty statement covering defects in material and workmanship. For more information on Flexport tyres, contact your Barloworld Equipment customer service representative.

Comfortable, stable, and durable.

Cat LED Work Lights

Light Emitting Diode (LED) technology eliminates lights maintenance

When you're working against the clock or at night, it can be costly to shut down a machine to change a light bulb. That's why more and more machine owners are upgrading their equipment to Cat LED Work Lights.

Unlike halogen lights, Cat LED Work Lights do not have a filament that will burn out, so there are no bulbs to replace or unexpected downtime. These lights also have a greatly extended life – more than 50 000 hours – and deliver bright illumination that improves operator safety and performance.

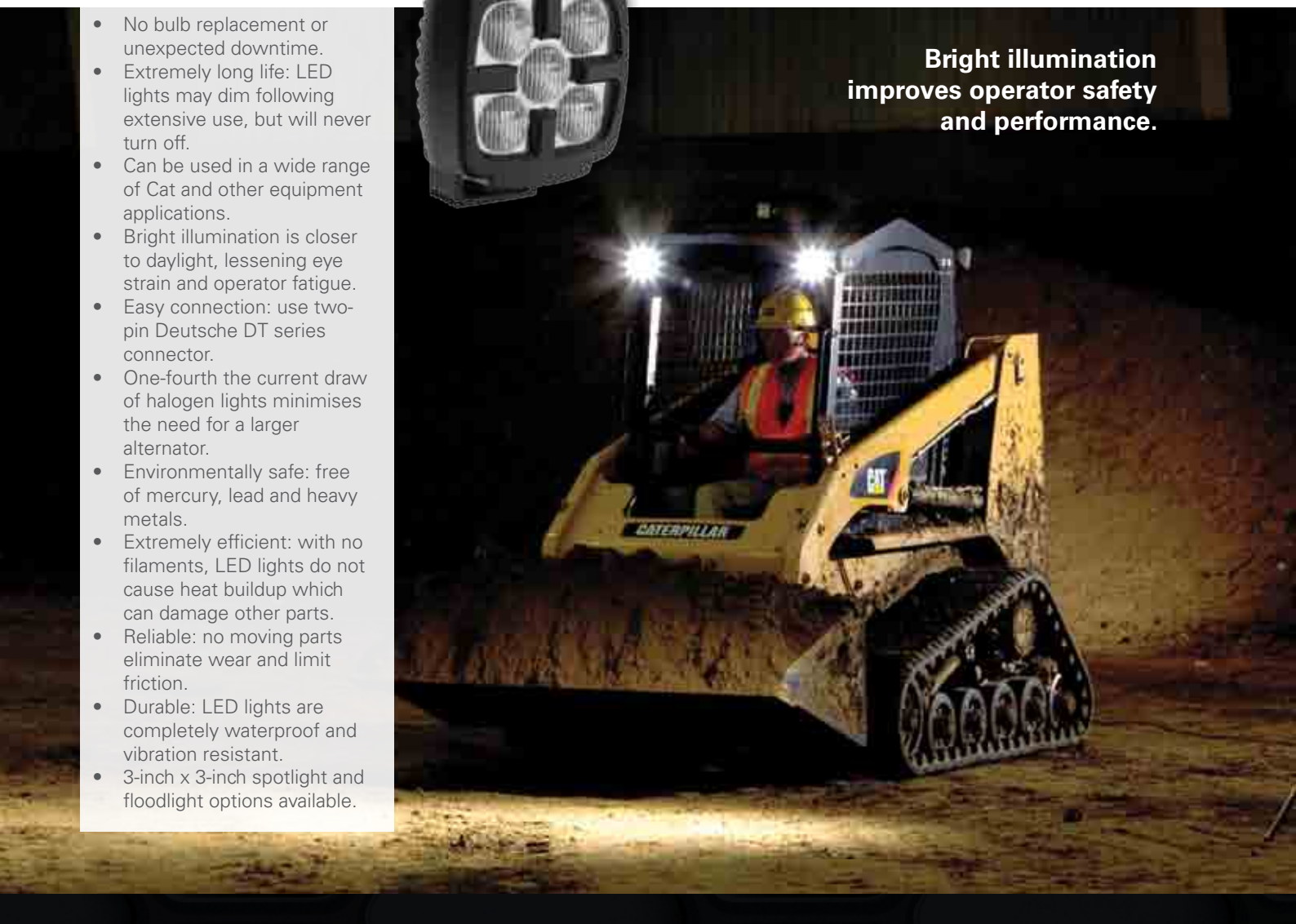
Suitable for a wide range of light and heavy-duty equipment applications, Cat LED Work Lights feature a common two-pin connector that permits easy change-outs of most same-sized halogen lights on Cat and other brands of equipment.

CONSIDER THE ADVANTAGES		
	LED	**Halogen**
Average Life Expectancy	50 000+ hours	1 000 hours
Power Consumption @ 28 Volts	0,6 amps	2,5 amps

LED lights have an extremely long life. These lights may dim following extensive use, but they will never turn off.

LED benefits explained

- No bulb replacement or unexpected downtime.
- Extremely long life: LED lights may dim following extensive use, but will never turn off.
- Can be used in a wide range of Cat and other equipment applications.
- Bright illumination is closer to daylight, lessening eye strain and operator fatigue.
- Easy connection: use two-pin Deutsche DT series connector.
- One-fourth the current draw of halogen lights minimises the need for a larger alternator.
- Environmentally safe: free of mercury, lead and heavy metals.
- Extremely efficient: with no filaments, LED lights do not cause heat buildup which can damage other parts.
- Reliable: no moving parts eliminate wear and limit friction.
- Durable: LED lights are completely waterproof and vibration resistant.
- 3-inch x 3-inch spotlight and floodlight options available.



Cat Machine Security System

The key to theft deterrence

Theft and unauthorised use of equipment are big concerns. The Cat Machine Security System keeps your equipment safe by giving you control over both who can operate your machines and when.

Integrated into the electronics of Cat equipment, the Cat Machine Security System guards the starting system, engine, and transmission. Only a yellow or gray security key can start the machine when the system is armed.

The Cat Machine Security System gives you many options to help you manage your equipment. Each security key is unique so operators can be restricted to certain machines or hours of operation. The system can also be programmed to allow use of the standard black key during active periods, and then, for after hours, automatically rearm.

Benefits

- Theft protection.
- Restrict machine access to only known operators.
- Easily installs on all Cat equipment.
- Caterpillar designed and machine integrated.
- Potential insurance savings.
- Can also be used on competitive equipment.

How the Cat Machine Security System works

Each yellow or gray security key has a unique identification number. When a key is inserted into the ignition switch, the Cat Machine Security System electronic control module checks that key against the preapproved list. If the key is an unauthorised security key, or a standard black key, the machine will not start.

Controlling Machine Access

The Cat Machine Security System is programmable to give you the protection that best fits your needs:

- By limiting operators to specific machines, which prevents access by untrained operators or unauthorised personnel, thereby reducing damage and injury risks.
- Controlling the days and hours equipment may be started, which guards against unauthorised 'weekend use' of equipment.
- Programmable for active and inactive periods, such as disarming the system during regular work hours so that a standard key can be used and then reverting to security keys after hours.
- Program security keys to expire at a specific period of time.
- One security key can be programmed to operate any machine in your fleet.

The Cat Machine Security System is superior to more basic add-on theft deterrent devices because it is integrated into the electronics of the machine. This makes it virtually impossible to defeat.

Key Management

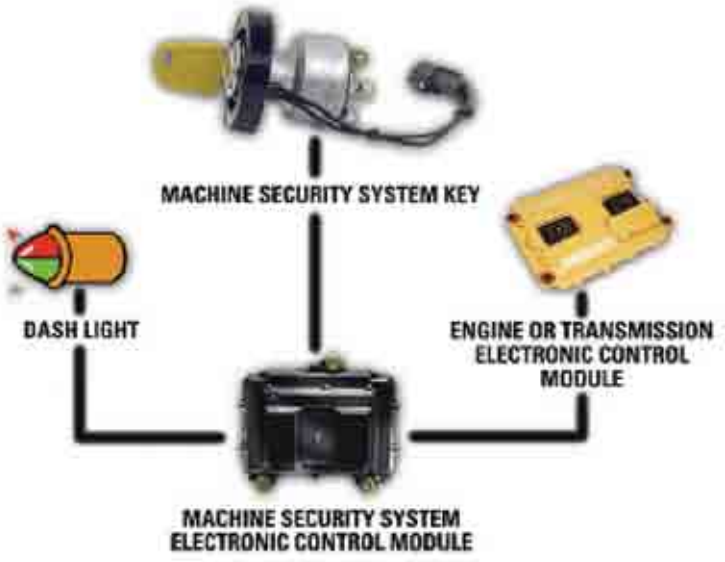
Programming the Cat Machine Security System is simple. An authorised Barloworld Equipment technician can quickly program your machine to start with a new key, or make changes for existing keys.

A machine can be programmed to accept many unique security keys.

Availability

- Factory available for many models.
- Can be field installed on your entire fleet, both Cat and competitive machines.
- Works on both 12-and 24-volt systems.

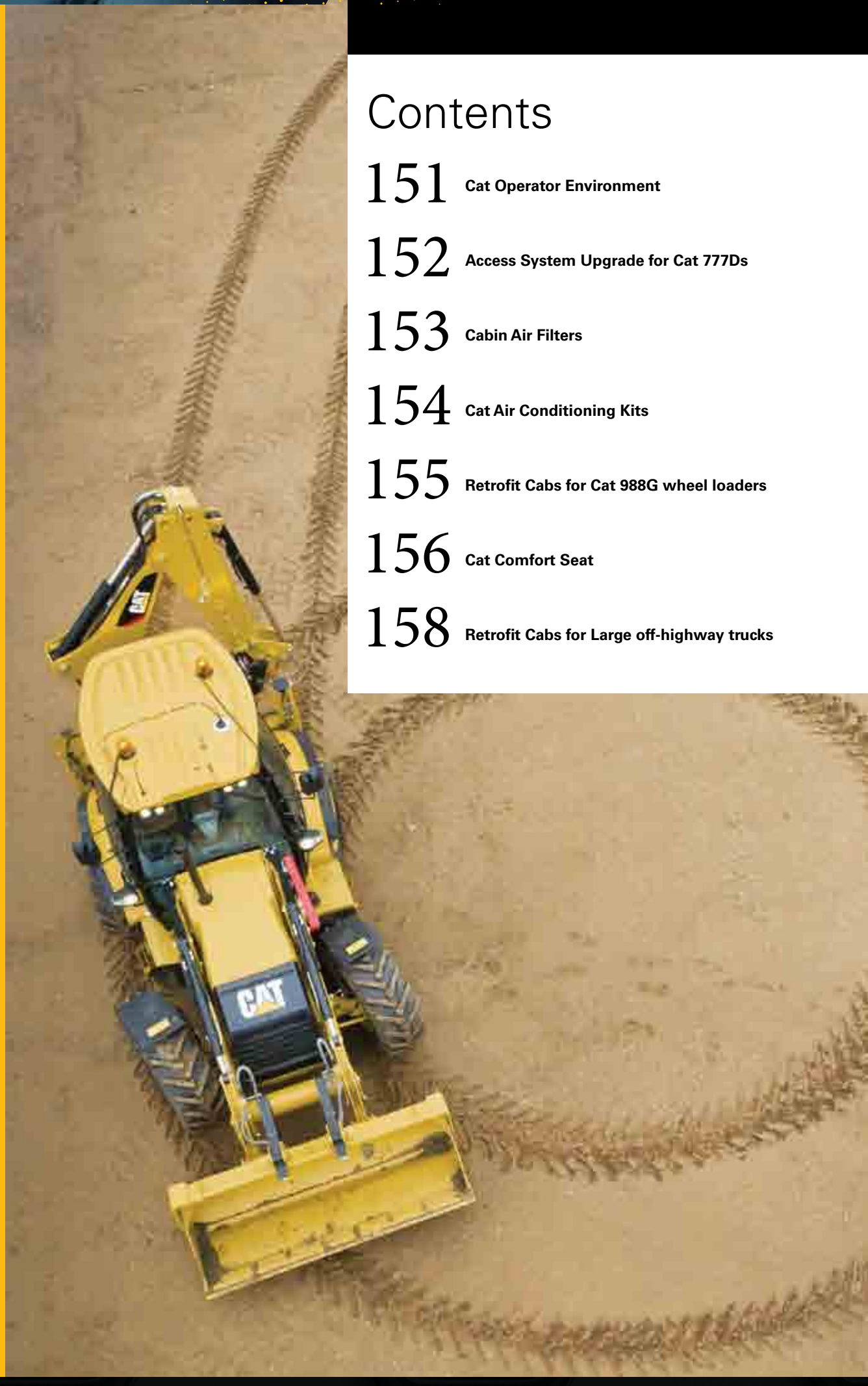
To find the field installation kit part number for your model, please contact your Barloworld Equipment customer service representative.


MACHINE SECURITY SYSTEM KEY
DASH LIGHT
ENGINE OR TRANSMISSION ELECTRONIC CONTROL MODULE
MACHINE SECURITY SYSTEM ELECTRONIC CONTROL MODULE

The Cat Machine Security System is superior to more basic add-on theft deterrent devices because it is integrated into the electronics of the machine.

One security key can be programmed to operate any machine in your fleet.

CABS AND ACCESSORIES



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The Cat Operator Environment

Employing the best operators starts with keeping them happy.

You can have the most productive machines on earth, but it doesn't count for much unless you have people who know how to get the most out of them.

That is why Caterpillar makes operator satisfaction a top priority, designing cabs with improved visibility and heating/cooling, as well as decreasing noise, vibration and fatigue with state-of-the-art ergonomic designs. It all adds up to an operator environment that's safer and more comfortable, helping make your operators' workday easier and more productive.

Choose from a wide range of options

Air Conditioning

- Retrofit kits are easy to install.
- These systems are designed to provide maximum cooling efficiency in the most rugged operating conditions.
- And they are engineered to fit like a factory-installed system.

Cabs

- Two types of replacement cabs are available: original equipment and retrofit upgrades.
- Original equipment cabs look and perform like new.
- Upgraded retrofit cabs are designed to include the latest engineering, productivity and comfort updates.

Lights

- High Intensity Discharge lights provide twice the light and last ten times longer than halogen lights.
- Halogen lights are shock resistant to provide longer life.
- Light Emitting Diode (LED) lights are designed for long life and lower maintenance.

Radios

- Heavy-duty radios have been tested and exceed shock and vibration standard SAE J1455.
- They withstand both hot and cold temperature extremes.
- Both XM and SIRIUS satellite models are available.

Seats

- Cat Comfort Seats have an ergonomic high-back design.
- Extra-thick, contoured cushions.
- And adjustable lumbar support.

Contact your Barloworld Equipment customer service representative for advice on ways to help enhance both your operators' environment and your bottom line.

Access System Upgrade: Cat 777D Series Trucks

Improved bumper walkway and cab access

Caterpillar is pleased to announce the introduction of a field installed, diagonal stairway retrofit kit for Cat 777D Series large off-highway trucks. The stairway improves access to and from the bumper walkway and cab, thereby reducing risks of slips, trips and falls.

The 777D Series retrofit stairway is 600 mm (24") wide and is integrated diagonally across the front of the machine. This kit includes a stairway, bumper extension, handrails and walkway.

Ordering Information

New 777D Series machines are equipped with the standard ladders. The diagonal stairway kits must be ordered as an optional retrofit kit. Retrofit stairway kits and associated serviceable components are available through the Barloworld Equipment parts system. Please contact your customer service representative for further information.

Model	Upgrade Kit Part Number
777D (3PR)	356-8750
777D (AGC)	356-8750
777D (FKR)	356-8750
777D (6XZ)	356-8750
777D (2YW)	356-8750

Product Support

- Detailed step-by-step Special Instructions (SI) with graphics are available electronically via SIS Web to reduce installation down time (Cat 777D – REHS5075 "Installation of the Ladder Gp and Catwalk As").
- Components individually serviced and backed by standard Caterpillar parts service and warranty.

Product Specifics: Cat 777D

- Retrofit stairway is 600mm (24") wide.
- Field installed attachment.
- Cat integrated and validated design.

Ease of access is an important factor in ensuring overall operator safety.

Safety Tip:

It should be noted that with the newly installed, diagonal stairway upgrade kit, Caterpillar instructs that individuals face the direction of travel when using the stairs, maintain a minimum of two points of contact at all times, and always have one hand in contact with the handrail.

New Cat 777D Series machines are equipped with ladders as standard.

Cat Cabin Air Filters

A cleaner, more comfortable cab environment

Two high efficiency filters, the Cat Dust Reduction and the Cat Dust and Odour Reduction Cabin Air Filter, improve ventilation and/or odour reduction in enclosed operator cabs. Advanced filtration technology reduces airborne irritants, creating a cleaner and more comfortable working environment for the operator.

An optional replacement for the standard filter, no equipment modification is needed for installation.

Dust Reduction Filter Benefits:

- Higher efficiency for better dust reduction.
- Direct replacement for standard filter.
- Fits current filter housing.
- Easier to clean.

Dust and Odour Reduction Filter Benefits (in addition to the above):

- High performance-activated charcoal ensures a fast rate of absorption.
- Higher capacity extends life and reduces maintenance costs.
- Superior particle removal efficiency reduces eye, nose and throat irritants.
- There is no adverse effect on air flow, heat or air conditioning performance.

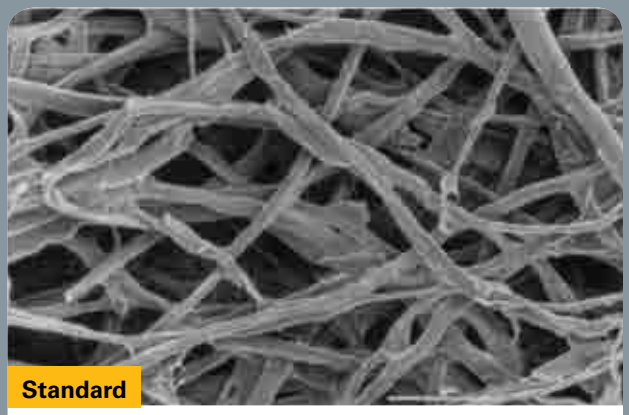
Please note that dust reduction and odour reduction cabin filters are not intended for filtering hazardous materials.

Both Cat Dust Reduction and Odour Reduction Air Filters can be cleaned with compressed air to extend life. They should not be cleaned if the dust / odour reduction capability is diminished, if the filter is damaged or has been used for 12 months of longer.

The Cat Dust Reduction Cabin Air Filter can be used anywhere excessive cab dust exists.

Machine coverage

- Integrated tool carriers.
- Track loaders.
- Track-type tractors.
- Off-highway trucks.
- Pipelayers.
- Soil compactors.
- Wheel loaders.
- Wheel tractors.

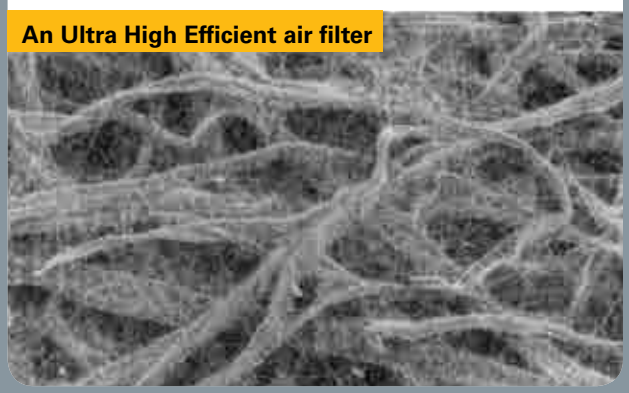


Standard

Reduced odour, high dust capacity, longer life

Cat Dust and Odour Reduction Cabin Air Filters are designed for use in landfill applications or anywhere superior odour reduction is necessary. They offer extended service life without compromising heating or cooling capabilities. The activated carbon in the filter (see magnification below) provides a fast rate of absorption. There is no operator exposure to loose carbon particles, even in rough applications.

An Ultra High Efficient air filter



KEEP IT REAL, KEEP IT CAT®

For more information contact our call centre on 0800 21 22 48 or visit www.barloworld-equipment.com

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Barloworld Equipment CAT

Cat Air Conditioning Kits

Improve operator comfort and boost productivity

Cat air conditioning kits provide an effective retrofit solution to combat the heat. All kits, except combined AC/Heater Kits, are designed for use with machines that have an AC-ready heater group installed.

The benefits

- ***Right fit:*** each kit is made for your Cat machine and contains parts to install a highly efficient R134A system in the cab.
- ***Durable:*** all parts are heavy-duty and made to withstand harsh operating environments and severe vibration.
- ***Easy Installation:*** quickly install components with easy-to-follow installation instructions.
- ***Good value:*** each part is covered under the Caterpillar New Parts Warranty.

These kits provide a field-installed, 12-volt or 24-volt R134A in-cab air conditioning system for the machines listed in the table (right).

A roof mounted air conditioning system.

CAT AIR CONDITIONING KITS

Machine Type	Model	AC Kit	Serial Number Breakdown						
Track-Type Tractor	D6R	192-1508	1RW	2HM	2YN	3ZN	4FM	4HN	4JR
			4MN	5LN	6JN	6MR	7GR	7KN	8LN
			8TM	8XN	9BM	9MN	9PN	9ZS	
	D7R	192-1509	2EN	2HR	3DN	5ZK	9HM		
	D8R	192-1510	7XM	9EM					
Wheel Loader	826C	* 232-7901	87C						
	908	+ 232-7906	8BS						
	938G	192-1513	4YS	6WS	9HS				
	950B	* 232-7901	22Z						
	950G	192-1512	2JS	3JW	4BS	5FW	8JW		
	962G	192-1512	3BS	4PW	5AS	6EW	7BW		
	966D	* 232-7901	99Y						
	966G	192-5373	3PW	3SW	3ZS	8XW	9RS	AAH	
	972G	192-5373	1EW	4WW	6AW	7LS	9GW	AAW	
	980C	* 232-7901	63X						
Compact Wheel Loader	906	+ * 232-7905	6ZS						
Off-Road Truck	768C	232-7900	02X						
	769C		01X						
	772B		64W						
	773B		63W						
Integrated Tool Carrier	IT38G	192-1513	1CW	7BS					
	IT62G	192-1512	6PS	AKP					
Motor Grader	12G	192-7424	61M7711-up						
	120G	192-7424	87V5734-up						
	12H	192-1511	2GS	2LR	2WR	4XM	8MN		
	120H	192-5372	2AN	4MK	6NM	6YN	9YR		
	130G	1927424	74V2059-up						
	135H	192-5372	3YK						
	140G	192-7424	72V4231-up						
	140H	192-1511	2ZK	3AS	8KM	9TN	9ZN		
	160H	192-1511	2HS	3GM	6WM	9EJ			
Telehandler	TH62	+ * 232-7910							
	TH63								
	TH82								
	TH83								
	TH103								
	TH220B	217-5973	SLA						
	TH330B		SLB						
	TH340B		SLC						
	TH350B		SLD						
	TH360B		SLE						
	TH460B		SLF						
	TH560B		SLG						
Skid Steer Loader	242	266-9213 + 266-9199	CMB						
	246	266-9207 + 266-9194	5SZ						
	236	266-9216	4YZ						
	252		FDG						
	262	+ 266-9189	CED						
Multi Terrain Loader	257	266-9213 + 266-9199	CMM						
	277	266-9216	CNC						
	287	+ 266-9189	CNY						

Table Notes:
* Incomplete kit. Additional parts required.
+ Combined AC/Heater Kit

Retrofit Cabs For Cat 988G Wheel Loaders

More Cab. Less Time.

Caterpillar is pleased to announce the availability of cost effective alternative solutions for cab rebuilds and replacement cabs for certain Cat 988G large wheel loaders.

These new retrofit cabs are designed as "plug and play" kits and they can be installed in a matter of hours. Further modifications might be needed if any additional attachments need to be transferred from the current machine cab.

Cat Retrofit Cabs offer value by upgrading to newer technologies and assuring ROPS integrity. On board is the Cat Comfort Seat with patented three point harness for improved operator ergonomics, helping to reduce fatigue, and improve alertness and general productivity.

The upgraded cab has all necessary certification labelling, including ROPS certification.

Features include:

- A/C.
- LED indicators in dash.
- EMS III.
- CB ready.
- HID lighting.
- Extended roof.
- Deluxe MP3 radio with USB port.
- Two 10 Amp Converters.
- Blade Fuses in E-bay.

Additional features include exterior paint schemes similar to current production cabs, folding mirrors and rear laminated glass.

For further information please contact your Barloworld Equipment customer service representative.

Large wheel loader customers around the world are targeting longer service life from their Cat machines. A complete upgrade cab satisfies the customer demand for improved machine availability and reduces concerns by providing newer technology and assuring ROPS integrity, operator satisfaction, comfort and safety.

Sales Model	Serial Numbers	Original Cab	Upgrade Cab	Installation Kit
988G	2TW	114-5145	346-3845	346-3844
988G	BNH	202-9738	346-3845	346-3844
• 346-3844 – mounting hardware and films to support the cab installation				
• 346-3845 – upgrade cab				

Cat Comfort Seat

With three-point operator restraint: made for comfort, made for mining.

The Cat Comfort Seat is available as a retrofit option on a wide range of Cat off-highway mining trucks and has proven advantages in terms of ergonomics and safety on the toughest sites.

CAT® COMFORT SEAT WITH THREE-POINT OPERATOR RESTRAINT

High-back design provides additional head and neck support for maximum operator comfort.

Infinitely adjustable lumbar support.

Dual Retractor Belt System with highly visible two-inch orange shoulder belt which is easily seen when properly worn and latched.

Extra-thick, contoured cushions with special side bolsters keep the operator positioned in the centre of the seat.

Fully adjustable arm rests can be "flipped up" and out of the way when not in use (dual arm rests are available only on certain applications).

Lower cushion tilt adjustment helps reduce operator fatigue and fits a wider range of operator sizes.

Cast gears for long life and durability.

Dampener adjustment allows the operator to tune the suspension to five "firmness" settings.

Proven Toggle Link Air Suspension System compensates for the operator's weight and provides maximum suspension travel.

Adjustment levers are at the front of the seat for easy operator reach.

As durable as it is comfortable

- Rip-resistant, tight-weave fabric.
- Asphalt black.
- Slip-resistant material.
- Special backing is fused, not sewn, to the underside of the material, allowing the material to stretch without sagging.

The Benefits

The Dual Retractor Belt System keeps the operator in the seat for a secure ride

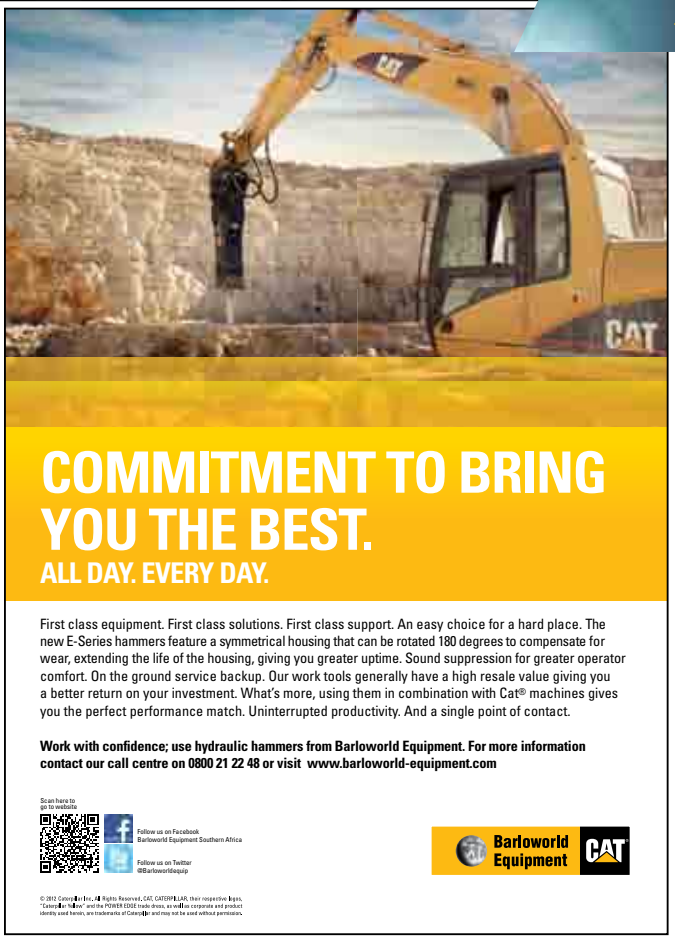
- Meets SAE J386 and SAE J2292 specifications.
- Bright orange shoulder belt is easily visible when properly worn and latched.
- Six vertical adjustment positions provide optimum fit for a wide range of operator heights.
- Emergency Locking Restraint (ELR): the shoulder belt functions "sense and lock" when conditions demand.
- Lap belt comfort with Automatic Locking Restraint (ALR): the lap belt automatically locks into position, but still allows operator movement without cinching.

Proven Toggle Link Air Suspension system ensures a smooth ride

- Optimal "Ride Zone" positioning is accomplished by adding (or removing) air to the proven Toggle Link Air Suspension.
- An indicator gauge makes it easy for the operator to see that the correct amount of air has been added to the system.
- Once adjusted, the seat will maintain the correct setting with no further adjustment until a shift change.
- The Toggle Link Air Suspension system has proven extremely durable in the most rugged applications, with over 10 000 hour life expectancy.

Cushions add to the comfort

- A negative rake feature enables cushion tilt adjustment, even while the operator is in the seat.
- Side bolsters on the upper cushion help keep the operator in the seat in rough applications.
- Cushion density designed for shift-long comfort.
- Cushions use a waterproof foam-in-place technology that is easily cleaned.
- Upper and lower cushions are individually replaceable.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COMMITMENT TO BRING YOU THE BEST.
ALL DAY. EVERY DAY.
First class equipment. First class solutions. First class support. An easy choice for a hard place. The new E-Series hammers feature a symmetrical housing that can be rotated 180 degrees to compensate for wear, extending the life of the housing, giving you greater uptime. Sound suppression for greater operator comfort. On the ground service backup. Our work tools generally have a high resale value giving you a better return on your investment. What's more, using them in combination with Cat® machines gives you the perfect performance match. Uninterrupted productivity. And a single point of contact.
Work with confidence; use hydraulic hammers from Barloworld Equipment. For more information contact our call centre on 0800 21 22 48 or visit www.barloworld-equipment.com
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Model	Serial Number Prefix	Seat Part Number	Special Notes
769D	5SS, BBB, 5TR	228-3351	If the original machine seat had a two-point restraint, a new riser must be installed with the new Cat Comfort Seat with three-point restraint. Order 153-4001 in addition to the specified seat.
771D	BCA, 6R, 6YS		
773E	BDA		
775E	BEC		
776D	5ER, AFS		
777D	6XZ, AGY, AGC, DCB, 2YW, 3PR, FKR		
785C	1HW, APX, 5AZ		
789C	2BW		
793C	CBR, 4AR, TY, 4GZ		
770	BZZ		
772	RLB, 59X, 10S, 11S, 80S	240-8716	
773F	EED		
775F	DLS		
777F	RP		
784B	5RK	252-9713	If the original machine seat had a two-point restraint, a new riser must be installed with the new Cat Comfort Seat with three-point restraint. Order 144-4184 in addition to the specified seat.
785B	6HK		
789B	7EK		
793B	1HL		
797	5YW	244-2803	If the original machine seat had a two-point restraint, a new riser must be installed with the new Cat Comfort Seat with three-point restraint. Order 144-4184 in addition to the specified seat.
797B	SM	244-2803	

Retrofit Cabs for Large Off-Highway Trucks

A lot more cab in a lot less time

How do you keep large off-highway trucks in operation while, at the same time, upgrading their capabilities? The Cat Retrofit Cab is a rebuild or replacement option that can help do both by providing upgrades and cutting installation time. Rebuild time for an outdated cab is normally measured in weeks, but Cat Retrofit Cabs can be installed in less than a day.

The fully assembled cabs are available for Cat 785, 789 and 793 B and C Series off-highway trucks, with an exterior paint scheme and markings similar to current production cabs.

Each Cat Retrofit Cab includes:

- All new components (including Electronic Control Modules), ROPS and cab mounting hardware.
- New, updated wiring harnesses.
- New Vital Information Management System 4.0 (VIMS). The cabs are equipped with VIMS 4.0 for better monitoring of truck operations and payloads.
- The Cat Comfort Seat with patented three-point harness.
- A full-size buddy seat.

Cat Retrofit Cabs offer value by upgrading to newer technologies and assuring ROPS integrity.

The "plug and play" design requires less than a day for installation, minimising downtime.

Retrofit cross-reference chart

The information in this chart will help match the Retrofit Cab Upgrade Part Number to the truck application by machine sales model and serial number prefix.

These Upgrade Retrofit cabs replace same series machine cabs. These cabs are not intended to upgrade from a lower series model.

The Retrofit Cabs that are compatible with Hydraulic Automatic Retarder Control (ARC) are 785C and 789C series. The Retrofit Cabs that are compatible with the Air ARC are 785B, 789B, 793B, and 793C.

Large OHT	Serial Number	New Retrofit Cab Part No.	Original Cab Part No.
785B	6HK00433 and up	260-1831	114-9461
785C	APX00451 and up	250-6900	174-0515
789B	7EK00277 and up	260-1830	114-9460
789C	2BW00659 and up	250-6899	174-0519
793B	1HL00195 and up	257-2728	135-9986
793B	1HL00195 and up	257-2728	114-9460
793C	4AR	259-6879	124-7684
793C	4GZ	250-6898	137-0793
793C	ATY	250-6898	174-0523

South Africa	
Alexandra Bay	027 831 2880
Bellville	021 959 8200
Bloemfontein	051 409 1200
Boksburg	011 898 0000
Durban	031 569 8500
East London	043 736 1003
George	044 874 2227
Isando	011 929 0000
Khatu	053 723 9900
Kimberley	053 832 9300
Mthatha	047 531 4710
Middelburg	013 283 5500
Nelspruit	013 752 3264
Newcastle	034 315 2847
Phalaborwa	015 780 2405
Polokwane	015 297 5670
Port Elizabeth	041 402 4700
Pretoria	012 804 5538
Richards Bay	035 797 6300
Rustenburg	014 596 7727
Sandton	011 301 4000
Trichardt	017 638 1941
Welkom	057 352 4407
Wolmaranstad	018 596 3063
Mozambique	
Beira	002 582 332 2540
Maputo	002 582 130 0331
Botswana	
Francistown	00267 241 3547
Gaberone	00267 395 1781
Jwaneng	00267 588 4359
Orapa	00267 297 0027
Zimbabwe	
Harare	00263 448 6609
Zambia	
Kitwe	00260 212 211 191
Lusaka	00260 977 771 191
Swaziland	
Manzini	00268 518 7048
Malawi	
Blantyre	00265 187 0666
Lilongwe	00265 171 0344
Angola	
Lobito	00244 272 224 927
Luanda	00244 222 460 220
Sao Tomé & Principé	00244 222 460 220
Lesotho	
Maseru	00266 223 12995
Namibia	
Walvis Bay	00264 6420 3454
Windhoek	00264 6128 04600
Democratic Republic of Congo	
Lubumbashi	00243 992 901 300

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